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ABSTRACT

Policy issues relating to the integration of information and communications technology into higher education are addressed, primarily for those with policy development responsibility at the state level. The following chapters are included: (1) "State Higher Education Policies in the Information Age: An Introduction to the Issues" (Robert G. Gillespie, Richard W. Jonsen, and John P. Witherspoon); (2) "Implications of Introducing New Technologies into Higher Education" (Mara Mayor); (3) "The State Environment: A Context for Developing Telecommunications Policy" (James R. Mingle); (4) "Principles and Guidelines for a Coordinated Telecommunications Plan" (Dwight D. Dively); (5) "Finance Issues in the Telecommunications Age" (Michael B. Goldstein and Suzanne H. Woolsey); (6) "The Role of the Faculty in the Use of Learning Technologies" (Patricia J. Dewees and Lee C. Frischknecht); (7) "Ownership of Intellectual Property and Implications for State Policy" (Richard D. Marks); (8) Strategies for Familiarizing Policymakers and Educators with Information Technologies" (Ralph D. Mills); and (9) "State Leadership: The Key to Successful Integration of New Technologies into Higher Education" (Patrick M. Callan). Two appendices are provided: a policy on televised instruction adopted by the Coordinating Board of the Texas College and University System, and a description of Project ALLTEL (Assessing Long Distance Learning Via Telecommunications) and its recommendations. (KM)

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State Higher Education Policies in the Information Age

Co-Editors
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Western Interstate Commission for Higher Education

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The Western Interstate Commission for Higher Education (WICHE) is a nonprofit regional organization established by interstate compact to help western states to work together to provide high-quality, cost-effective programs to meet the education and manpower needs of the western region. Member and affiliated states are:

Alaska	*Nevada*
Arizona	*New Mexico*
California	*North Dakota*
Colorado	*Oregon*
Hawaii	*Utah*
Idaho	*Washington*
Montana	*Wyoming*

WICHE's three major goals are to:

- Assist the states to achieve their economic and social needs by identifying requirements for technically and professionally educated persons;
- Promote excellence in higher education through greater effectiveness and efficiency of programs while reducing duplication of programs among states;
- Strive to ensure adequate opportunities for students through improved access to education.

Among its activities, WICHE is working with member states to establish a regional cooperative whose goal is to promote, through resource and information sharing, the use of telecommunications and other technologies for higher education.

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FOREWORD

Technology is transforming the way higher education goes about its business—that is, its missions of teaching, research and public service. Rapid advances in information and communication technologies have meant profound changes in how we learn and what we learn.

Along with these changes has come the need for more understanding of how these new learning and teaching tools can be most effectively developed and applied in higher education and a need for greater coordination. The Western Interstate Commission for Higher Education (WICHE) sees a significant role for regional resource sharing in this regard, and it has pursued that objective for a number of years.

Initial efforts by WICHE were to gauge the direction and the extent of activity in colleges and universities in planning, developing, and using technology to enhance and expand access to quality postsecondary education. We learned that planning to integrate technology in administration and instruction was occurring somewhat at the campus level and less often, if at all, at the system or state levels. Moreover, the planning generally focused on the hardware and overlooked careful examination of policies that would be required to ensure that the technology would be used most effectively and in a cost efficient manner.

This volume provides a beginning for state and campus policymakers to understand the scope of the policy issues relating to the integration of information and communications technology. This book is addressed primarily to those with policy development responsibility at the state level. These include the chief executives and staff members of statewide higher education governing and coordinating boards and members of the state legislative and executive branches who have responsibility for higher education and telecommunications decisions. In a less formal way, we assume that many individuals in multi-campus system offices and individual campuses who are involved in the process of state decisionmaking can benefit from this publication.

A number of dedicated professionals from the higher education, technology, and legal fields contributed their time and expertise to this publication. They are the thirteen authors whose works follow. They represent a committed and talented group of people who share the excitement that technology offers and also are well aware of the new and difficult policy questions that higher education officials will have to address. To each of the authors, our greatest thanks for your excellent work and contributions.

WICHE would not have been able to assemble this group of authors without the support from the project's funders. The Frost Foundation, Ltd. was the principal funder, and we are especially grateful to its president, Edwin F. Whited, and to Theodore Kauss, the foundation's executive director, who from the start of this project has been an interested and supportive participant. Special thanks also goes to Mary Leslie and the Pacific Telesis Foundation, and Jane Prancan and U S West whose contributions also supported this work.

Special thanks and recognition are due the following staff and consultants: Richard W. Jonsen, WICHE's deputy director, who identified the need and developed the concept for this book, Mollie McGill who served as the overall publication editor and coordinator of the project, Ronald J. Turner, from the University of Missouri, who participated in the conceptualization and critique of several chapters, Kathleen Kelleher who provided excellent editorial assistance in the preparation of the final manuscript, Joyce Long who designed the cover and layout of the book, and Dorothy Read, for her exceptional assistance in preparing the typed manuscripts.

Boulder, Colorado
September 1987

Phillip Sirotkin
Executive Director
Western Interstate Commission
for Higher Education

STATE HIGHER EDUCATION POLICIES IN THE INFORMATION AGE: AN INTRODUCTION TO THE ISSUES

1

Robert G. Gillespie
Richard W. Jonsen
John P. Witherspoon

HIGHER EDUCATION is the linchpin of the Information Age. Colleges and universities have unique capabilities to generate and use information (a fundamental, expandable, renewable resource), develop its associated technologies and apply it for the benefit of humankind. The research functions of higher education spark changes in the technical, intellectual and business sectors. The teaching, training and retraining functions of higher education spark critical awareness and thinking in individuals who are leaders of tomorrow.

The Information Age coincides with a time of intense introspection about the quality of the curricula in postsecondary education and heightened awareness of the crucial role higher education must play in an increasingly international society and economic marketplace. Consider the following issues:

- If the U.S. is to retain a technological edge and improve its position in the emerging global market, universities must create active and imaginative programs of research in science and engineering fields that are related to the advancement of information/communications technology.

- With so many new occupations dependent upon a working knowledge of the latest information/communications technology, institutions of higher education must be prepared to provide career-long instruction and reorient curricula towards a clientele that is older and more experienced than the traditional 18- to 22-year-old student population.
- Institutions of higher education must also reach out to previously underserved students now that technology offers further means for reaching these students. Colleges and universities must make education more widely available in locations other than the traditional campus setting to meet the continuing education needs of professionals.
- The overwhelming proportion of new jobs created during the last decade have been in information and service categories. The college curriculum must respond by offering courses that critically evaluate and appraise the advantages and disadvantages of moving towards "an information economy."
- With respect to the problem of "information rich" versus "information poor" sectors, curricula of higher education must critically appraise attendant social and political problems, offer approaches to evaluate the costs and benefits and recommend policy that is in the best interests of society.
- Institutions of higher education must further cultivate relationships with business and consider the different types of joint ventures that are available to higher education and industry.

A Rationale for Planning and Integration

The foregoing discussion suggests some areas where higher education institutions will play a key role in providing the transition to an information economy and global marketplace. Yet, only in select cases is the higher education enterprise prepared to take on such a challenging role. As exciting and numerous as the opportunities are, they are in danger of not being realized because the policies that have served higher education in the past are ineffective in the Information Age that we are entering. The new technologies raise a number of policy and planning issues that policymakers and educators alike need to address.

"Integration" is an expression of the Information Age which refers to a critical component of planning for the development and use of technology in higher education. Integration—a concept of infusing the technological hardware, software, applications, training and management throughout the entire higher education enterprise—requires a clear statement of the link between institutional goals and the capabilities of the new technologies, on one hand, and the support and involvement of administrators and faculty, on the other. Ideally, integration should occur at multiple levels:

- Technical integration is the capability to electronically link different technologies, making it possible to have electronic systems of communication such as electronic mail and computer conferencing.

- Data integration involves the coordination of numerous files, such as student records, payroll records, alumni records and integrating them into a centrally administered file.

- Functional integration refers to the ability to take advantage of technical and data integration in such a way that the functions of the university—teaching, research and administration—can be interconnected, coordinated and accessible to a variety of users throughout the system.

Policymakers and educators must encourage integration at the campus, system and state levels. Successful integration, particularly at the functional level, requires considerable planning, coordination and communication among all departments (or campuses). If information- and communications-technology-based systems are developed in a piecemeal approach, the opportunities for improved quality of instruction, increased productivity and possible cost savings may be lost.

As important as is the need for the integration of technologies with one another and into the functions of higher education, a central concern of this publication is the development of appropriate new policies that will create an environment where technology supports overall state educational objectives. These are discussed below.

New State Policies

There is clearly a need for state policies that direct how new learning technologies are to be best integrated at the institutional and system levels. There is also a responsibility that the state play a more active role, albeit one that is tempered with caution, intelligence and a recognition of the complexities involved.

Policy development takes place in a framework of implicit or explicit state interest in higher education. State interest addresses varied issues of equity, access, efficiency in the use of state resources, diversity and quality. Each of these concepts is relevant to the integration of information technologies into higher education, and each of these concepts raises questions for policymakers as they consider the optimal outcomes of integrating new technology into higher education.

- ***Equity.*** States need to be concerned about the equitable use of learning technologies in higher education. If they are used primarily in educational activities that are required to be self-supporting, will people who cannot pay be denied their use?

- ***Access.*** How can state policies encourage the use of new technologies to make programs available to underserved clienteles, such as adults in rural areas and homebound persons?
- ***Efficient use of state resources.*** If educational excellence demands that colleges and universities employ learning technologies in their work, what policies will encourage innovative approaches to instruction and research as well as cooperation among institutions?
- ***Diversity.*** Public policy has emphasized diversity of institutional type in higher education, such as research universities, comprehensive urban institutions, and community and technical colleges. However, emphasis on diversity has not extended to the means and content of instruction. Can state policies encourage innovative uses of new information/communications technologies to promote greater diversity in program offerings and content?
- ***Economic development.*** Improving education at all levels strengthens a state's competitive position in attracting new industry, particularly high-technology industry. In many states, this has been the motivation to develop technology-based academic programs, particularly in engineering and business. Can state policies encourage higher education to develop programs that make the state competitive and attract industry by training its students so that they have the skills in demand today?
- ***Quality.*** As information technology becomes integrated in all aspects of higher education, achievement of excellence will become the principal motivation for using it. Can state policies encourage the enhancement of instructional quality through use of new technologies? Can the traditional role of the faculty be effectively preserved and integrated into the use of new technologies?

Policy development is accomplished in the course of carrying out traditional functions of budgetary oversight, coordination, program review and regulation. The following chapters focus on the content of needed new policies, recognizing that the development and execution of those policies involve a host of players and, most important, a need for leadership.

Synopsis of Book

Because new technologies are being integrated into higher education in a somewhat haphazard fashion, new policies are needed to rationalize the process. This book identifies the kinds of policies that will provide a hospitable environment for the appropriate and imaginative integration of new technologies into higher education.

Chapter 2 identifies fundamental ways to improve the quality of higher education via new learning technologies. New technologies present

opportunities to make students more active in the learning process, for example, as well as provide them with additional resources to carry out research.

Chapter 3 looks at the impact of technology on the functions performed by state higher education agencies—that is, coordination, regulation, productivity and quality control. Examples of some state responses provide some practical approaches to consider.

Chapter 4 suggests some specific principles for developing a coordinated statewide plan for telecommunications. State agencies need to develop policies governing the use, control, operation and funding of telecommunications systems, and those policies should be closely integrated with assessments of the needs of higher education.

Chapter 5 explains the implications of different kinds of financial burdens placed on states as a result of introducing new technologies into higher education. The alternatives presently available to finance the integration of new technologies into higher education are also described.

Chapter 6 focuses on the crucial role that faculty members play in the successful integration of learning technologies into higher education. By examining some success stories, it becomes clear that proper recognition must be accorded to faculty members who are incorporating learning technologies into their teaching.

Chapter 7 advocates that states and institutions of higher education approach the new learning technologies as a business and take into consideration the legal aspects of technology-based courses and software. This chapter explains how, by concentrating on contractual and financial issues early in the process, the chances of successfully integrating new technology into higher education are increased.

Chapter 8 promotes the idea of cooperation between states and institutions of higher education for the purpose of securing state-level support for integrating information/communications technologies into higher education.

Chapter 9 concludes that the final element required to successfully integrate technology into the enterprise of higher education is one of state-level leadership and suggests some actions that state leaders can initiate. □

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IMPLICATIONS OF INTRODUCING NEW TECHNOLOGIES INTO HIGHER EDUCATION

2

Mara Mayor

IN CONFRONTING both the technical and policy concerns that surround the introduction of the new and not-so-new telecommunications technologies in higher education, it is easy to lose sight of their educational potential. The true promise of the technologies is that they can provide new tools to ensure that students have access to an education of high quality. The purpose of this chapter is to identify some of the ways that the new technologies can improve the teaching and learning that occurs in our colleges. Within that context, it then suggests some of the concerns that face policymakers who are attempting to integrate learning technologies into higher education.

In assessing the ways in which the technologies can foster improvements in the quality of education, three broad categories of opportunity emerge:

- rethinking the content and structure of courses and disciplines;
- emphasizing the student as the center of learning; and
- providing students with access to a degree program regardless of their physical location.

Each of these categories deserves elaboration.

Rethinking the Content and Structure of Courses and Disciplines

Good teachers regularly think about how to teach a course so that a student's command of knowledge and methodology are increased. Less frequently, scholars in a field reconsider the design of the underlying

structure of the discipline itself, exploring whether new developments might require changes in the content and methodologies of the field. New technologies are beginning to foster such examinations at both the course and disciplinary levels. Consider an example of each.

Lower division courses in history provide a good illustration of what is possible at the level of the individual course. Undergraduate courses traditionally involve a teacher, students and printed texts. Introducing the resources that can be made available through the technologies can significantly change the structure and content of the course. Imagine an undergraduate course about the American Civil War. Even today, with a single videodisc able to store 54,000 frames of text or images, it is technically possible for the student to have ready access to photographs, drawings and reenactments depicting life at that time. Diaries written by soldiers and civilians during the Civil War and secondary sources that are now only available in very select libraries can all be made available on laser discs, each of which can hold tens of thousands of pages of traditional text.

Videotape can further add to the student's personal library, providing documentary and dramatic insights into the period as well. Computer-based simulations of all sorts could make it possible for students to take the roles of Lincoln or Grant, confronting the choices available to these leaders at crucial decisionmaking points.

All of these resources are technically possible now. Once they become available, it is hard to imagine a teacher restricting students to printed material and the local college's limited library. As faculty members begin to incorporate such resources into the syllabi of their courses, they will of necessity begin to rethink how the content of the course can best be presented to take advantage of the new materials and analytical tools available to their undergraduate students.

The availability of such resources will also have an impact on the shape of entire disciplines. In fact, it is already happening in some of the sciences and social sciences. In economics, for example, the availability of spreadsheet software and large data bases create opportunities for undergraduates that were previously available only for graduate students. Faculty must rethink the order in which concepts are presented and modify the sequence of courses.

The same type of innovation is beginning to occur in the humanities. Classics is a good example of a field in a healthy state of ferment. A group of scholars, centered at Harvard University but involving colleagues from across the country, is currently involved in a project to enlarge the resources for those who teach courses centered on the ancient Greek world, from Homer to Alexander the Great. They propose to use the storage capacity of laser discs and the interactive capacity of computers to make available

a huge body of information. They will use the discs to store primary texts (in both Greek and translation), secondary sources, maps, pictures, plans, aerial photographs and moving images. Their goal, however, is not simply to create a unique library, but also to design it in such a way that faculty members and students can easily access it. Moreover, they plan to put the design for discrete courses on discs so that students would have a structured, guided path through the material. Once resources and tools of such large scope are available, it will be possible and necessary for faculty to think about how the entire field should be structured and taught.

The Student as the Center of Learning

Courses that utilize the new technologies will require more responsibility on the part of the student, as well as call on the student's creativity. By putting more emphasis on the student as the center of learning, use of the technologies can contribute to improvements in the quality of higher education.

One approach is to give students more control over the speed and depth of what is being taught. Sophisticated computer-based materials that act as an intelligent tutor present this possibility. For example, the Massachusetts Institute of Technology is currently developing computer-based exercises in five languages. These modules use sophisticated hardware and software that are powerful enough to permit students to practice conversation. The exercises encourage natural discourse by helping the students to understand the rituals in common speech and to place language in a cultural context. Students proceed at their own speed, practicing skills and exploring the complexities of the language.

Another possibility is to give students access to new types of data bases, such as the one envisioned for classics, and permit them to make their own trails. The process is similar to what happens now in a library when students use the catalogue. They follow clues that take them from Socrates to Athens, and from there to the Peloponnesian War. If lucky, the students might also be able to wander through the stacks, browsing through whole sections of books that are roughly in the area of the subject of interest.

The same experience will be available with the new, on-line data bases. The crucial difference is that the range of resources is likely to be far more diverse. The student studying a Greek play, for example, will be able to sit at a terminal and move readily from maps of Greece and Athens to pictures of the Agora, and then to images from Greek vases that depict myths related to those in the primary work. The students will be able to analyze and synthesize various types of information, moving easily within and across disciplines.

The student's control over the way he or she learns is also heightened by creating new opportunities to work with other students or to communicate readily with faculty members. Relatively simple applications of technology, such as electronic mail and computer conferencing, can easily be used to encourage such activities. Additionally, new software is currently being developed that will permit students to share their writing with other students who, in turn, can comment and raise questions via the computer. Tools of this sort will encourage the notion that the process of writing can be a collaborative enterprise—as it typically is in the work world. Small teams of learners working together on projects can promote learning, and the new technologies—particularly those that are computer-based—foster an environment that encourages such collaboration.

A Degree Regardless of Location

Providing access to a degree program regardless of a student's geographic location is a third area in which the learning technologies offer new opportunities. Changing demographics make it increasingly important that institutions and states make education available in locations where it has not traditionally been available.

The pool of students of traditional college age is shrinking. *The Chronicle of Higher Education* reports that the proportion of the labor force between the ages of 16 and 24 will shrink from 30 percent in 1985 to 16 percent in 2000 (Fields, 1986). As the labor pool continues to decline, higher education will be just one of many sectors competing for the interest of these young people.

Simultaneously, older workers are forming a significant source of potential students, including those who do not have a college degree, those who need additional courses to stay current in their field, and those who want a graduate degree. These people cannot attend classes during traditional hours. They require opportunities to learn that are not encumbered by time and space constraints. The new technologies offer several possibilities for long-distance learning.

Many colleges have started to experiment with ways to reach potential students who have busy schedules. Some use television-based courses sent directly into the home or workplace. Some work with systems that use instructional television fixed services (ITFS) to send live pictures of on-campus lectures to off-campus sites. In some cases, two-way audio permits the student located at a distance to participate in the discussion. Still other systems use slow-scan video to supplement the one-way video and two-way audio. All of these efforts are effective, yet the number of courses offered by such means remains tiny compared to the number of courses taught by traditional methods. More can and will be done in the next years

to refine approaches that use the new technologies to overcome the barriers of time and distance.

Creating electronic highways for delivering course materials is a pressing need. Public television is a logical highway, with the advantage of reaching about 98 percent of all homes in America. Yet, because of competing demands for finite air time, public television stations typically restrict their course offerings to a few hours a week. Cable television is another highway but, its availability is spotty, reaching only about 50 percent of households in the nation.

The Public Broadcasting Service has recently initiated a new attempt to fill the gaps by launching the National Narrowcast Service (NNS). It uses public television's satellite resources to deliver courses to the stations, which then send them by microwave or cable to schools and companies that have receiving capability. Thus NNS serves students and employers at the work site with educational offerings that range from undergraduate liberal arts courses to highly technical courses for specific groups of professionals such as nurses.

Creating opportunities for making a college degree more accessible requires more, however, than increasing the physical availability of courses. Students also benefit from the chance to share ideas and interact. Telephone conferencing can provide an avenue, although it is somewhat constraining in its need to have all parties participate at the same time. Computers offer another avenue, with the advantage of fostering a conversation when the time is convenient to the participant. The potential is being encouraged by the New Jersey Institute of Technology, for example, which is embarking on a modification of their computer conferencing system to make it easier to use for teaching purposes. When their system is complete, the software will be available to colleges that wish to adopt computer conferencing to teach full courses or to supplement courses. By providing students with more personalized interchange, the technologies can expand the attractiveness of education that is not delivered face to face.

The availability of full-degree programs (as opposed to isolated courses) will also increase access to education for students who require flexibility. Perhaps the most notable example of an effort to provide a full-degree program is the National Technological University. Drawing on faculty from all over the country, it delivers courses in engineering for three master's degree programs to worksites around the country. It is a model with relevance for the undergraduate level as well.

Issues that Need to be Addressed

Even this brief description suggests the broad implications of the technologies for higher education, ranging from the shape of individual

courses to the structure of full degree programs. As educators and policymakers reach to achieve those possibilities, several concerns need to be addressed.

It is critical that administrators at the college and state level be flexible in their approach to the technologies. Rigid standards will block precisely the kind of creativity that needs to be encouraged. Consider one example. Over the years, it became standard for a television-based course to have between 26 and 30 half-hour video programs. It is easy to conclude that, if 26 half-hour segments assured a certain level of quality in the past, then all future courses should contain 26 half-hour segments.

But as the technologies make possible a more diverse mix of formats for teaching, rigid formulas become confining. For example, what if a television-based course is combined with computer conferencing, so that the faculty member can converse with the students and teach via the computer? What if some of the course material is provided on audiocassette because its content does not lend itself to visualization? What if compact discs provide students with access to resources that enable them to carry out more creative analysis and writing? The combination of video with one or all of these approaches might be far more effective than printed material and the standard 26 30-minute video programs. Therefore, an environment is needed in which such possibilities can be tested. Policymakers need to be open to new ways to achieve quality.

Policymakers also need to encourage creative evaluation efforts to assess the impact of the new technologies in higher education. In the rush to try a good idea, with an eye to keeping costs low, it is understandable that evaluation gets little attention. Yet it needs to be recognized as essential if the strengths and weaknesses of the application are to be identified so that the next iteration can be stronger. Assessing the impacts on learning of the new technologies might require new approaches to evaluation, but the information gained will be worth the effort.

Creating a reward system for faculty that recognizes creative teaching, including a willingness to experiment with the technologies, is also essential. While a few faculty are genuinely fearful of the technologies, seeing them as a threat to their jobs or self-esteem, most are simply neutral. They must be helped to see that the technologies are constructive tools that can serve them and their students. Ways need to be found to educate the educators, and then to reward them for the commitment to teaching.

Each of these concerns raises policy questions.

- How can standards be established to assure quality without blocking the development of innovative applications of new technologies that enhance learning opportunities?

- What steps can be taken to ensure that evaluation components are built into experimental applications of new technologies? Who pays for them?
- What incentives can be provided to faculty members to encourage creative teaching as well as creative research?
- To what extent can public policy determine faculty rewards? To what extent should it?

As answers to these questions are sought, it is important to keep in mind the ultimate goal, which is access to an education of quality. □

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***Mara Mayor** is director of the Annenberg/CPB Project, which provides support for efforts that use the telecommunications technologies to enhance the quality and accessibility of higher education.*

THE STATE ENVIRONMENT: A CONTEXT FOR DEVELOPING TELECOMMUNICATIONS POLICY

3

James R. Mingle

THE NEW telecommunications networks that can link campuses, faculty members, and students over great distances are compatible with the concept of state coordination. A concept of coordination that is advocated (but seldom adopted) envisions a fully integrated system of higher education operating at maximum efficiency. In the utopian world of planners, only "necessary duplication" exists as the states simultaneously meet near-impossible demands for access, excellence, and efficiency. In reality, however, planners and the public have had to settle for far less than the ideal. Rather than implementing the grand coordinated strategy, they have settled for cycles of "turn-taking," with the priorities being access, excellence, and efficiency. What excites many state planners about the new technologies is their potential to contribute simultaneously to all three of these objectives. But potential and reality remain leagues apart. The new technologies have to be accepted, paid for, and utilized by the old bureaucracies.

This chapter focuses on the dynamic interaction between trends in state government and trends in telecommunications technology. On one hand, factors such as competition and innovation in state funding policies in recent years have affected higher education's ability to acquire and integrate new learning technologies. On the other hand, integrated systems of voice, video, and data are providing opportunities for state governmental agencies to be directly linked with institutions of higher education. This chapter describes the state's role in developing and promoting integrated statewide networks.

The Changing Nature of Coordination

State coordination of higher education is "alive and well," according to its founding father, Lyman Glenny (1985 p. 1). It has survived an unrelenting barrage of criticism over the years, and has now become institutionalized. All but a few states have either established some form of independent coordinating structure or strengthened the ones already in place (Education Commission of the States, 1986). They "do not do so capriciously," says Glenny (1985, p. 1), but rather they do so in reaction to the "unseemly competition among the colleges and universities for students, for new programs and for funds."

While many critics of coordination have charged it with "leveling down" or "political intrusion," the origins of statewide coordinating and governing boards are exactly the opposite. By depoliticizing decisions in the funding of higher education, the states sought to protect higher education from political intrusion and at the same time create equitable funding systems. For the most part, coordination has been a holding action, aimed at trying to solve problems created in the past. The apparently irrational array of locations of programs and institutions in most states was no accident. Rather, it was the result of political log-rolling where the winners were often those institutions located in the districts of influential legislators.

Always playing a catch-up game, state coordinators gained new tools and new powers in the 1960s and 1970s. State planners began dealing with a set of issues that now encompasses nearly every aspect of higher education, including academic standards, technology acquisition, and intercollegiate athletics. The tools of the trade and the lexicon of state coordination have now become familiar. These include role and mission statements that set guidelines for program growth and retrenchment; program approval and review processes (similar to accreditation reviews), used mostly for rationalizing growth, sometimes for quality control, and rarely for retrenchment; formula development aimed first at establishing equity and then at creating quality goals; capital expenditure priorities coupled with rigorous analysis to replace the old pork-barrel distribution system; and, more recently, licensing and quasi-accreditation legislation to insure minimal standards among the growing number of new private and proprietary institutions which are seeking state approval in order to gain access to the wealth of the federal financial aid system.

No organization charged with such disparate goals as access, excellence, and efficiency can be consistent over time. State boards are not. Viewed from the outside, they appear ambivalent and confused about their objectives. Should they advocate or regulate? politicize or analyze? confirm the status quo or force the new age? These are the questions which force state boards

to look not two ways, as Robert Berdahl (1971) claims, but many different ways in the pursuit of their agenda.

In the 1980s state coordination headed in new directions. Border relationships increased in importance. Linkages with schools and industry became important. New groups and individuals emerged as important actors in policymaking. Staffers—ambitious and bright young people—became ubiquitous in the state house and the governor's office. Blue-ribbon commissions competed with state boards to establish the agenda for higher education. An expanded executive branch added offices of economic development and offices of technology and communications to coordinate the new telecommunications networks that were being developed in state government.

The 1980s has also witnessed a crisis in confidence of sorts. Partly the product of the spillover from educational reform of the schools and partly the product of higher education's lack of vigilance, the accountability movement of the 1980s has dramatically shaped the agenda of state boards. The ambivalence about the role of state boards is still there, however, as they attempt to monitor quality (tradition) and encourage innovation.

Competition, Innovation, and State Planning

State boards are sensitive to the trends, issues, and attitudes in the political sphere. As attitudes shift, so do the agendas and strategies of state boards. The virtues of competition as reflected in deregulation of the airline and telecommunications industries have already had substantial effect on state policies of higher education. In states with highly regulated environments, institutions have gained new autonomy in the management of their affairs, especially in the management of funds, personnel issues, and purchasing (Mingle, 1983; SUNY, 1985). This new freedom has been won primarily from the executive branch of state government and its various bureaucracies. However, campuses have found themselves under even greater scrutiny in areas defined as policy (as opposed to management). Formerly sacrosanct issues are now being debated in public. Academic standards are a good example. Today, some state boards are very involved in setting admissions standards and in developing progression and exit standards as well.

Due to the aggressive stance of state legislators regarding academic accountability, state boards are taking their cues from governors who make education central to the state agenda. Educational issues are thus quite visible in the 1980s, as is political involvement. Intervention by governors and state boards, however, is a new kind of political involvement. The free-market atmosphere has infected even the most regulatory-minded states and agencies. Competition has come to the public sector in the form of

"incentive funding," that is, competitive grant funding, modeled after programs of the National Science Foundation and the Fund for the Improvement of Postsecondary Education. State boards are circulating requests for proposals (RFPs) that outline objectives and goals and ask institutions, as well as departments and individual faculty members, to present their proposals. Subsequently, these proposals go through a peer-review process. Funds are used to leverage institutional change and implement state priorities.

High among the priorities targeted by incentive funding have been the upgrading of equipment (usually computer-related hardware and software) and, more recently, the improvement of undergraduate teaching by, for example, encouraging the use of technology in new delivery systems. While none of these state initiatives is on the grand scale of the Annenberg/CPB Project, the mechanisms are now in place to encourage a wide range of innovation.

Technology, Divisions of Labor, and Status

No concept has been more basic to state coordination than the concept "mission differentiation." It was problems such as "degree creep" and one-dimensional interpretations of excellence such as "the research university" that led state boards to establish formal guidelines for institutional growth and development. The mission statement, which spells out in varying degrees of detail what institutions can or cannot do, has become an article of faith among state planners.

Mission statements have attempted to account for differences in clienteles served, resources available, and market demand. They have also been guided by something more basic—the territorial imperative. Domestic tranquility has been the primary goal as state boards awarded their franchises for delivering such money-makers as off-campus, teacher education instruction or popular new professional programs such as graduate engineering in urban areas and high-tech corridors. However, telecommunications could change this. A territorial franchise that provides teacher education to a local population makes less sense when one of the alternatives is a telecommunications network that includes central studio productions broadcast via satellite across the state.

Will telecommunications systems affect how the status and power of institutions is perceived in the states? Without a doubt. For this reason, state telecommunications plans will be scrutinized closely by institutions. Will telecommunications systems further diminish the role of regional institutions or elevate a few so that they receive new statewide missions? Richard Van Horn (1986), president of the University of Houston, argues that technology, through its information-sharing functions, is inherently

democratizing. Even the lowliest and most isolated institution will have the potential to access the world's finest libraries and most noteworthy faculties.

Long-Distance Instruction

Higher education is "unprepared for the superhighway" which technology has laid at its feet, according to Clyde Ingle (1986), commissioner of higher education in Indiana. Despite a great deal of interest in long-distance learning technologies, utilization remains spotty and demand relatively weak. Statewide inventories that were taken to ascertain if institutions were interested in telecommunications found that they were primarily interested in data exchange and research. The West Virginia Board of Regents (1987), for example, found that instructional uses of technology were ranked well below uses such as data and person-to-person communications.

States have found that there is interest in applying telecommunications to continuing education and in-service training. For quite some time, professional instruction in the health fields has been delivered in the workplace, and this practice is rapidly being adopted in the engineering field. In contrast, teacher education is a field in which education is not delivered at the workplace. At a recent conference on technology, a participant was asked what technologies were being used in his state to deliver instruction off campus. "The airplane," he answered, and then described how faculty members are flown to and from remote locations once a week.

Students, especially undergraduates, overwhelmingly prefer to meet as a group to receive instruction. And, despite the greater cost and inconvenience, employees prefer the social interaction of the classroom. The market for long-distance instruction thus appears to be groups of workers receiving instruction at the worksite.

To adjust to the demand for greater access outside of traditional institutions, state boards will need to expand their linkages with the business community and the local schools. Rather than coordinating campuses, they might be coordinating "instructional sites" located in offices and factories. High schools could become the receiving point for both college-level instruction for accelerated students and for professional development training for high school teachers.

Integrated Networks

State boards play an important role in the development and promotion of integrated, statewide networks that link data, voice, and video

communications to a large number of sites. This is often carried out in conjunction with state offices of telecommunications, which can have similar goals for all of state government.

The growing interest in networks has been stimulated by a number of factors. Deregulation of the communications industry has spurred competition among providers and resulted in a wide range of technological innovations. Fiber optic cables carry extraordinary amounts of data and are rapidly replacing copper wiring and microwave systems, at least among urban areas that are easily linked and wired. At the same time, new supercomputer centers have been established at sites around the country by the National Science Foundation (NSF). NSF's backbone network is the base for a number of regional networks connecting major state universities. Such networks not only make it possible to share resources, but also aid in the research process by connecting scholars in different locations who are working on similar problems. State systems can provide gateways to these research networks and link less sophisticated institutions to a statewide network.

Telecommunications networks are linking state institutions of higher education, as well as integrating state government, thereby creating very efficient networks. In Indiana, for example, the state is developing a backbone network that utilizes fiber optic cable that will eventually consolidate all state agencies and public institutions of higher education into a single network. A telecommunications commission appointed by the governor found that such a system would result in savings of $25 million to $250 million over a ten-year period. The network will be fully integrated and greatly increase the video capacity available to higher education.

The New Jersey Department of Higher Education included a priority request for $9 million in its fiscal year 1988 budget to establish an intercampus telecommunications network that would link all the public and private degree-granting institutions in the state (Stohn, 1987). The committee that studied the issue concluded that such a network would contain escalating costs of communications by achieving economies of scale at a time when many institutions are attempting to upgrade their computing and communications capabilities. A number of improvements are expected with respect to sharing and accessing resources in a state which has already developed sophisticated library and student aid networks.

The West Virginia Board of Regents wants to link three major providers in the public sector: the state's colleges and universities, the elementary-secondary broadcasting authority, and the state's emergency medical services. Members of the board envision a fully integrated and coordinated network that will provide dedicated circuits for voice, video and data transmission. Total cost of the program is estimated at over $11 million.

State Funding Systems and Telecommunications

State funding of higher education is usually directly related to workload: the more students taught, the more money received. Implicit or explicit formulas and less formal appropriations mechanisms pay additional increments for additional students enrolled. This relationship has been weakened in recent years, however, as states have protected institutions from the brunt of decline in enrollment and pumped money into the systems under the aegis of "quality improvement." States that are unable to fully fund enrollment growth in popular institutions have allowed student tuition to rise as an offset to declining per-student state support. The mix of different strategies has generally obscured the close relationship between appropriations and enrollment, and it has weakened the power of state funding formulas. Nevertheless, workload factors built into formulas continue to influence institutional behavior and worry advocates of distance learning. Are funding formulas and rules for determining workload acting as restraints on the use of instructional technology? It is a question which state boards will face quickly if they establish large-scale, distance learning programs.

In 1985, the Texas Coordinating Board began a pilot program to deliver graduate teacher education programs via satellite (Whittington, 1987). Two institutions offered the classes, and seventeen others signed a participation agreement to offer credit for the courses. As Whittington (1987, p. 2) suggests, participation in the network requires substantial commitment on the part of the delivering institution: "Faculty must fly to the San Antonio uplink one night a week to conduct a three-hour class." To overcome this problem, the coordinating board has asked for funding of an expanded pilot project which would include additional uplinks and downlinks around the state. It should be noted that, while the institution offering the long-distance learning incurs substantial costs, the participating institutions offering the credit bear relatively few costs. Yet if formula-funded support for these enrollments were withdrawn, the motivation for participation would also disappear. Thus, the job of the coordinating board is to find the appropriate balance of support.

Much of the funding of distance learning programs is found outside the regular operational budget. Since most instruction via television continues to supplement rather than supplant classroom instruction, there has been no pressure to devise new ways of determining workload. If the instructional mode involves additional start-up costs, state boards usually ask for special legislative appropriations to cover these costs. Or, as in Oklahoma, they have asked private foundations to cover start-up costs and then leveraged this support to pressure the state to add additional support.

With respect to developing their own telecommunications networks, some states are finding that with initial investments they have the potential for not only greatly expanding their capacities, but also realizing savings over the current lease-line arrangements. As it was discovered in Indiana, however, realizing such savings will call for a coordinated acqeisition strategy that involves all of state government (Ingle, 1986).

The Problem of Productivity and Quality

Few fields, including the health field, have been as resistant to productivity improvements as higher education. However, there are several factors that could change this lack of concern. The federal government and state governments are reaching the limits of their spending power. Tuition—financed increasingly through student borrowing—has made up some of the shortfall, but this source of funding might also be reaching its upper limits.

In light of pressures on appropriations and tuition, why is technology seldom viewed as a solution to the productivity problem? The standard answer has been that higher education— like many service industries— is labor-intensive. Furthermore, cutbacks in face-to-face contact between faculty and students have always been viewed as a decline in quality. It even seems that unqualified lecturers who teach in a traditional setting are preferred over more qualified lecturers operating at a distance. Access to a library generally means on-site access. These ideas are universally assumed in a variety of codes and standards established in state licensing laws, accreditation standards, and program review criteria. They can also be noticed as biases when state board members ask: "Is television instruction as good as regular classroom instruction?" (One wag asked, "Is it also as bad as regular classroom instruction?") It should be noted that state boards reflect the dominant ideas and values held by institutions of higher education. Colleges and universities are status-maximizers, and to date they have not granted status to long-distance learning.

A reason for resisting technology is "sunk costs," incurred in the past and not easily or quickly liquidated. These include land, buildings, equipment, laboratories, and employees with job security rights that are closely connected to a particular process. When an institution resists buying and integrating new technology due to sunk costs, it runs the risk of becoming completely outmoded and bypassed. For example, the American steel industry had substantial sunk costs in the 1950s and 1960s. This was a time when new technologies were being developed. Because it resisted innovation through new technology, it has in large part disappeared.

What is the potential for new technologies to reduce costs in higher education? In the short term, the potential seems high, but the likelihood seems low. Libraries continue to build their collections independently of each other. Demands for new instructional programs are being met in traditional ways. (The expansion of traditional engineering programs is a case in point.) Lists of capital spending are more likely to give priority to new buildings over new telecommunications systems. Even in states where telecommunications is a priority, there is not guaranteed support by the governor or legislature. The budget recommendations that emerge from state telecommunications plans run into millions of dollars, and seldom do they provide any rigorous cost-benefit or needs analysis. States could benefit by following the example of Indiana. In Indiana, it was found that a presentation of existing networks before the legislature made the duplication apparent. As a result, support increased.

Most arguments for technology projects are based on the improvement of quality. This approach is a supplemental strategy, and any supplemental strategy is likely to aggravate the problem of productivity. Televised instruction, with its high capitalization and production requirements, is cost-effective only when enrollments are large. Communication and data networks can reduce the problem of costs in higher education only if they act as a substitute for expansion. In other words, technology-based solutions must be viewed as alternatives (not just as enhancements) to traditional ways of operating if they are going to serve the goal of efficiency. For example, access to a data base through a personal computer must be viewed as a substitute for a visit to the library, and use of videocassettes and self-paced software for instruction must be substituted for in-person lectures.

Technology and Quality Control

Institutions traditionally present state and system boards with a fait accompli in the program area when they add courses and faculty on an incremental basis. When it comes time for final approval, the institution argues that the resources are already in place. However, this type of no-cost proposal for new programs will not work with new technologies. Although the out-year costs might be low due to economies of scale, the start-up costs are high (heavy in investment), requiring early acquiescence and approval by state boards. This should improve quality control.

If televised instruction and network programming are adopted, program review may be more easily carried out. Reviewers can "look right into the classroom," as it were, and directly judge the quality of instruction. Software is also more easily evaluated than traditional classroom instruction.

Many observers have worried that state agencies, including state boards with licensing authority, would regulate and limit distance learning. But

the power of the state is limited by law (especially protection provided interstate commerce) and by the amount of time that can be spent in investigating and reviewing institutions. With respect to regulation of the private sector, state boards should limit their activities to consumer protection by insuring minimal standards of academic integrity and fiscal responsibility and leave more qualitative evaluations to the institutions and accrediting community (Chaloux, 1985). □

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PRINCIPLES AND GUIDELINES FOR A COORDINATED TELECOMMUNICATIONS PLAN

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Dwight D. Dively

THE STRUCTURES, functions, and powers of most state higher education agencies were defined before technology became an important consideration for colleges and universities. As a result, few states have policies governing the development and use of educational technologies. The growth of technologies such as telecommunications, supercomputing, and computer-aided instruction will therefore require major changes in current state policies and regulations and will produce changes in the activities and operations of institutions of higher education. State agencies will need to develop policies governing the use, control, operation, and funding of technological systems. These policies will have to be integrated with assessments of educational needs and be developed with the broadest possible input from individuals both inside and outside the system of higher education. It should also be noted that successful implementation of these policies usually requires active involvement and support from senior state policymakers.

The purpose of this chapter is to examine current regulation of technology by states in the context of existing administrative systems and describe the effects of educational technology on state policies. This chapter also notes the principles that should influence the formulation of state policies regarding the use of technology in higher education, and concludes with recommendations regarding the development and implementation of these policies.

Existing State Systems

Each state has a unique administrative system for higher education. The systems differ in structure and function, as well as the extent to which they regulate uses of educational technology. States currently use three basic types of organizational structures for administering higher education.

Governing Organizations. About half the states have a central governing board that oversees higher education. These boards are usually vested with substantial regulatory and budgetary powers. Individual institutions may also have their own boards, but these local boards usually have little authority in comparison with the state agency.

Regulatory Organizations. About 20 states have regulatory bodies that set certain policies for higher education, but lack the overall authority given to governing boards. In these states, individual institutions maintain considerable autonomy.

Coordinating Organizations. The remaining states have agencies charged with planning and coordinating the activities of institutions of higher education. These agencies have very limited regulatory powers, so individual institutions have great autonomy.[1]

In addition to these differences in organizational design, the span of control of state agencies varies significantly. In some states, the governing agency is responsible for both two-year and four-year schools, while in other states these systems are separated. Vocational education and K-12 education may also be under the control of the same agency that governs higher education.

Regardless of the organizational structure, most state higher education agencies consist of an appointed board plus a full-time staff. The relative power and influence of boards and staffs vary from state to state.

The functions of state higher education agencies are closely intertwined with their structures. Powerful state governing boards usually have a wider range of functions than do coordinating agencies. However, most state higher education agencies have at least four functions.

Needs Assessment and Planning. Most state agencies are required to conduct periodic needs assessments and prepare state higher education plans. These plans cover roles and missions, enrollments, programs, budgets, and a variety of other issues. In some states, these plans are binding on institutions; in other states, they serve only as guidance.

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[1]The distinctions among the three categories of organizations are somewhat arbitrary. It is especially difficult to identify the point at which a coordinating organization becomes a regulatory organization. Thus, different sources may present somewhat different totals for the number of states in each organizational category.

Programmatic Regulation. State agencies usually regulate higher education offerings in two ways. First, most states impose registration or licensing requirements on institutions offering degrees. For in-state public institutions, these requirements may include prior approval before any new program is offered. This program review function is designed to ensure educational quality and avoid unnecessary duplication. Second, some states actively review existing programs offered by in-state public institutions. Such reviews are intended to promote quality, identify unmet needs, and eliminate outdated programs. Program regulation by states is supplemented by a network of regional and national accrediting bodies that review the quality of programs and institutions.

Budgetary Review and Control. States with powerful governing boards usually grant such boards control over many parts of the higher education budget. The board often develops a proposed funding package for the governor and legislature, and also may control the ultimate allocation of funds. In states that do not have as much central control, the higher education agency may be involved in budgetary review.

Other Functions. States have assigned a variety of other functions to higher education agencies, such as responsibility for financial aid, federal programs, or special state initiatives. These functions are unlikely to be affected by educational technology, and thus will not be discussed further.

Current Regulation of Technology

Although technology has influenced higher education for several decades, the major impacts of technology have been felt only in the last few years.[2] As a result, few states have comprehensive policies or regulations affecting educational technology. The rapid evolution of technologies and the wide range of other problems besetting higher education have further dissuaded state agencies from developing active roles.

Despite this general trend, a few states have started to establish policies governing specific uses of educational technologies. For example, Texas has set up policies to encourage the growth of instructional television in ways that will ensure quality. (See Appendix A for a copy of these regulations.) The motives for actions taken by different states vary, but four seem particularly important.

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[2]Technologies such as videotapes and instructional television have been used in the U.S. since the 1950's. By the mid 1960's, some major off campus instructional delivery systems were in place, such as the University of Florida's microwave system that distributed engineering courses to NASA sites. However, systems with major implications for statewide planning were not deployed until at least ten years later. Among the best examples of such systems are the Appalachian Education Satellite Project, which delivered inservice education to teachers, and Pennsylvania's PENNARAMA system, which combines microwave and cable distribution.

Concerns About Access to Education. In many states, institutions of higher education are under pressure to broaden access to programs. In some cases, this involves service to areas without colleges or universities. In other cases, broader access is sought for time- and place-bound students, particularly working adults. Educational technologies, especially telecommunications, are often proposed as ways to expand access. These technologies also received attention in the early 1980's as ways to bring courses to new industrial sites, and thus became a part of many state economic development efforts.

Reviews of Proposed Programs. State interest in educational technology sometimes stems from proposals made by individual institutions. In these cases, a college or university proposes a new initiative involving instructional technology, often as a way to expand off-campus programs.[3] In order to evaluate and coordinate such programs, state agencies may need to establish overall policies for educational technology.

Reviews of Budget Requests. Some state agencies have developed educational technology policies in response to institutional budget requests. Institutional requests for capital funds to purchase supercomputers, satellite uplinks, data networks, and related equipment are becoming common, and similar proposals are often introduced by legislators or others outside the system of higher education.[4] State higher education agencies may need to develop policies to analyze or respond to these types of proposals.

Responses to National or Regional Discussions. In the last five years, educational technology has received considerable attention at the national level. Several major studies have been made, including the ALLTEL project conducted by the Council on Postsecondary Education and the State Higher Education Executive Officers. (See Appendix B for a summary of the ALLTEL project.) Some attention has also been paid to the possibilities for regional cooperation in obtaining and using educational technology.[5]

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[3]For example, interest in off-campus telecommunications in Washington was spurred by a proposal for a satellite uplink made by Eastern Washington University in early 1986. This uplink was proposed as a way to offer advanced courses to rural high school students and was intended to be self sustaining. The system is now in place and is meeting its educational objectives, but it has a large budget deficit. Concerns about this deficit and about the system's service area stimulated the development of a statewide telecommunications plan.

[4]Alabama's recent supercomputer initiative is an example of such a proposal. This program involves the purchase of a supercomputer by the state and the development of a network providing access for universities and industries.

[5]For example, WICHE, working with the Northwest Academic Planning Forum, has recently received support from the National Science Foundation to establish a supercomputer network linking universities in Alaska, Idaho, Montana, North Dakota, Oregon, and Washington. The project's first phase involves the development of a network connecting university computer facilities to the NSF supercomputer centers.

Such national and regional activities have led some states to focus more closely on the regulation of technology.

Another aspect of current regulation of educational technology should also be recognized. Most states have a central agency that handles many technological functions, including data processing and telecommunications. This agency often has some influence or control over colleges and universities. Even when higher education operates independently, state policymakers may mandate cooperation as a way to avoid duplication of systems. Thus, any effort to develop policies related to educational technology must consider the roles of other state agencies.

Effects of Technology on State Policies

As noted earlier, higher education policies and regulations in most states were adopted long before educational technology became a major issue. Some of these policies will not be affected by the growing use of technology, and in many other cases technology can be accommodated with only minor changes in policy or procedure. However, increased use of educational technology will have at least nine effects that may require significant changes in existing state policies and regulations.

More Competition. The availability of telecommunications systems, especially videotapes and satellite transmission, allows colleges and universities to offer programs far from their home campuses. Other information technologies, such as CD-ROM (compact disc read-only-memory) and long-distance data transmission, allow these off-campus programs to be supported without the need for expensive on-site computer and library facilities. As a result, there will be increasing competition in many areas of higher education, especially in popular fields such as business, education, and engineering.

State policymakers will need to develop new approaches to deal with two types of competition. The first is competition among in-state public institutions, which may seek to broaden their service areas beyond traditional boundaries. In many states, public colleges and universities were established in the 1800's and early 1900's. Population and industrial growth has often occurred in cities other than the ones where these colleges and universities are located. This has created a geographical mismatch between educational needs and educational resources. The availability of educational technologies will encourage institutions to overcome the mismatch, with considerable potential for competition and duplication.

The second type of competition is competition with other institutions, including private universities, private companies, out-of-state public universities, and groups of universities. By using telecommunications, all of these providers will be able to expand their service areas. One example

of this approach is the National Technological University, a consortium of institutions offering graduate programs in engineering fields. Courses from participating universities are distributed throughout the U.S. using satellite transmission and videotapes. Programming can be received at industrial sites or at open sites accessible to all interested individuals. The quality and wide distribution of these courses may make them major competitors for traditional on-campus graduate programs.

Changes in Offerings. New technologies make it easier to provide more off-campus and non-traditional classes. In many states, enrollments and funding for such courses are handled differently than regular on-campus classes. Growth in non-traditional programs at a time when some on-campus enrollments are declining may require changes in state policies. For example, funding policies based on full-time-equivalent students may need to be redesigned to allow for a large influx of part-time students.

Effects on Access. Telecommunications and data transfer technologies will increase access for time- and place-bound students. However, technology will not overcome many of the socioeconomic barriers that limit access to higher education, at least not in the short run. The deployment of a state network that distributes courses to homes will not, by itself, ensure that more people can sign up for academic or vocational classes. Policymakers seeking to expand access may need to revise state policies to respond to these technological effects.

Effects on Service Areas. Many states have defined service areas for two-year and four-year institutions. Some types of educational technology make such service areas impractical and financially wasteful. For example, a university with a satellite uplink automatically distributes its programs throughout a state, not just within its own service area. Although the university may be restricted to its service areas for institutional or political reasons, cost and access considerations suggest that broader service is desirable. Thus, policies regarding service areas may need to be revised.

Changes in Quality Measures. Many of the traditional quality measures applied during program review and approval need to be modified for technology-based programs. Two types of quality must be assessed for these programs. The first is technical quality, including clarity, reliability, and technical expertise. For example, a review of an off-campus video program should examine the quality of the video and audio signals, the frequency of system outages, and the operating expertise of the staff. The second is instructional quality, which often involves different factors than regular on-campus instruction. Courses offered using educational technologies usually require that special attention be focused on clarity of expression, preparation of visual aids, and the ability to solicit comment from students in remote locations. Many systems have discovered that high

technical quality is of little value if the programming is not attractive and understandable for students. State higher education agencies may need to develop new standards for reviewing programs offered using technology.

Opportunities for Multi-Institutional and Multi-State Cooperation. Many information technologies can be used most effectively by groups of institutions. Working together, several colleges and universities can offer better programs to more students at lower costs. For example, two-year colleges in a state may not have sufficient interest on a single campus to justify a particular program, such as a foreign language or vocational specialty. However, technologies such as satellite transmission could allow the colleges to work together and collectively offer the course. Furthermore, technology is not limited by arbitrary political boundaries, so cooperation among institutions in different states is often practical. State agencies may need to develop policies to regulate or encourage such multi-institutional cooperation.

Changes in Costs and Fees. Expanded use of educational technology, especially for off-campus programs, may require changes in how costs and fees are computed. On one hand, many new programs that rely on technology have high initial costs and low initial enrollments. This trend was illustrated by South Carolina's APOGEE program, which provides graduate engineering courses in several areas of the state. APOGEE had only 34 students when it started in 1970, but enrollment exceeded 300 students twelve years later. Many other programs that utilize educational technology show similar growth trends. If full-cost recovery is required for such programs from the outset, some of them will not be viable. On the other hand, some programs offered through technology, especially those that serve large businesses, may be able to generate fees far above those typically charged for off-campus courses. This may lead institutions to emphasize such programs to the exclusion of others; or, if high fees are prohibited by state policies, may result in a loss of revenue for institutions. The complexity of these issues suggests that many states will need to develop new policies regarding costs and financing.

Effects on Faculty and On-Campus Programs. In many cases, programs using information technologies can affect on-campus faculty and courses. For example, many courses offered via telecommunications use tapes or broadcasts of existing on-campus classes. This increases faculty workloads and sometimes leads to resentment by on-campus students. Faculty members may oppose such courses unless additional compensation or support is provided. In other cases, faculty commitments to programs offered through technology may reduce the number of on-campus courses. Several related issues may also arise, including faculty training for using technology, faculty release time, and institutional recognition of faculty members who participate in technological programs. At the present time,

many faculty members complain that states and institutions offer little preparation and few rewards for using educational technologies. New policies will be needed to address these concerns.

Changes in Relationships among Administrative, Instructional, and Support Functions. On most campuses, administration, teaching, and support have traditionally been independent functions. The increasing use of technologies for communication and data transmission will necessitate closer cooperation. For example, there is great interest in local computer networks for campuses, and considerable duplication would result if separate networks were purchased for administrative, faculty, and support use. However, agreement on a single network may require changes in structures, policies, or attitudes in order to succeed. Some state agencies and institutions will need to address this issue if efficient use of technology is to occur.

General Principles to Guide State Policies

Although every state is different, there are many common principles that should influence state policies regarding the use of technology in higher education. States with advanced policies may already have addressed most of these principles, while states just starting in educational technology may need to investigate the issues raised by all of the principles. A review of the experiences of several states and institutions suggests that eleven principles should be observed in developing state policies for educational technology.[6]

1. *Technology is a means, not an end.* Too often, educational technologies are deployed because of their newness, regardless of needs or proposed uses. In many cases, this has led to underutilized systems and excessive costs. Instead, needs for educational programs should be identified, and then technologies should be evaluated to see if they can help in meeting those needs.
2. *Technology requires rethinking of roles, missions, and service areas.* Many educational technologies can be used to send programs far beyond traditional on-campus locations. These technologies can serve new learners in new locations at new times. As a result, the traditional missions and service responsibilities of colleges and universities may need to be redefined if educational technologies are to be used extensively.
3. *Different situations require different technologies.* There are a wide variety of technologies available for higher education, and each

[6]These principles have been adopted with modifications from Dively (1987, pp. 31-32).

technology has unique strengths and weaknesses that make it suitable for specific needs. Educational needs and the prospective audiences for the courses should determine the types of technology that are used. For most states, a mix of technologies will usually be most effective in addressing educational needs.

4. *Technology changes rapidly*: Today's educational technologies will soon be supplemented and perhaps supplanted by fiber optics, computer-aided instruction, and other new approaches. Thus, it is essential that state policies be developed and evaluated in light of new and emerging technologies. Provisions should also be made to ensure periodic review and revision of technology policies.

5. *New technologies are not always the best.* In the rush to adopt new methods, established technologies are sometimes overlooked. These older technologies are often more reliable, less expensive, and more easily understood. They should continue to be considered for future uses.

6. *Individual technologies should be considered in the context of a broader spectrum of technological capabilities.* Educational problems rarely occur in isolation, and thus policies affecting a particular technology should recognize potential interactions with other technologies and other educational issues. For example, a policy affecting off-campus courses offered through video telecommunications should include provisions relating to the possibilities of integrating voice and data communication. The voice and data systems are essential for meetings, counseling, computing, and many other functions that can be critical to a program's success. In some cases, separate systems will be needed, but in other cases an integrated approach could increase efficiency and save money.

7. *The success of a system is determined by its quality*: The market for providing higher education is growing more competitive each year. Public colleges and universities are being challenged by private institutions, out-of-state universities, corporate education programs, and satellite broadcasts from other states. In this competitive environment, only high-quality programs will survive.* State policies regarding educational technology should emphasize high-quality programs targeted to the needs of local students.

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*Many educators and policymakers assume that programs offered using technology are of lower quality than on campus classes. However, research has shown that technology programs that are properly designed can equal on campus effectiveness. For example, students in Stanford University's off campus engineering programs receive average grades equal to or above their on campus counterparts (Gibbons, 1984, pp. 13-15).

8. *Instruction, not technology, is the largest factor affecting program quality.* The quality of the courses and instruction is the most significant determinant of the success of a program offered through educational technology. The technology is important only in that it must ensure clear access to the program at appropriate times and places.

9. *Coordination is valuable, but should not emphasize linkages for their own sake.* It is very useful for institutions to cooperate by sharing ideas and plans, and in many cases systems that serve several institutions are desirable. However, systems should not be connected or combined unless there is a specific programmatic reason to do so.

10. *Faculty involvement is critical to success.* Many faculty members are reluctant to use advanced educational technologies. Some instructors believe technology disrupts courses, others believe it increases workloads, and still others see it as a threat to their jobs. Faculty resistance can delay a program or dramatically reduce its effectiveness. Thus, proponents of new systems should involve key faculty members from the beginning of the development process.

11. *The cost-effectiveness of programs using educational technology can rarely be measured using on-campus costs.* Programs using technology are often designed to serve small, dispersed audiences that cannot be reached by traditional on-campus programs. It is therefore unrealistic to compare their costs per full-time student to the costs of regular instruction. Instead, a proper measure of cost-effectiveness is to compare the costs of these programs with the cost of serving the same students using traditional methods, such as adjunct faculty or evening classes. Furthermore, assessment of the cost-effectiveness of technology programs should recognize the indirect benefits of the programs, such as increased access to education and a strengthened economic development effort.

Recommendations for State Policies

The increasing use of technology will significantly change the nature, structure, and financing of higher education. In order to accommodate these changes, each state should have an educational technology plan for its higher education system. This plan can be a separate policy or can be woven into existing policies and regulations. Without a state plan, the potential for inefficient duplication, mismanagement, and failure to meet key educational needs is greatly increased.

Many factors influence the specific composition of a state educational technology plan. States with largely rural populations will have different

needs and will utilize different technologies than states with large urban areas. Rural states will probably emphasize satellite or videotape systems, while urban states may make more use of cable and broadcast technologies. States with powerful governing boards will probably require more detailed plans than those with less powerful coordinating agencies. Despite these differences, it is possible to provide some general ideas about the basic content of state educational technology policies. These policies should include information dealing with the following issues.

Needs Assessment. Before technology is adopted on a large scale, it is important to understand the needs that are to be addressed. In the past, many technologies have been adopted without careful attention to the needs being served. This has often resulted in inefficiencies and the need to redesign systems. States should therefore develop information describing the basic educational needs anticipated in the coming years. These assessments should recognize major state policy goals, such as increased access, higher quality, or educational programs to support economic development. Educational technologies should be reviewed in light of these needs, recognizing the unique strengths and weaknesses of each technology.

Goals. Any state educational technology policy should have a clear list of goals. Ideally, the list should identify specific needs to be addressed, how each goal will be achieved, and a timetable for deploying the programs needed to meet the goals. These goals should be developed by using the needs assessment and by consulting individuals inside and outside the educational system. Among the groups that should be consulted are:

- Educational leaders, who will be responsible for implementing the policy.
- Instructional design experts, who can advise on programs that can be used to meet specific needs.
- Technology design experts, who can discuss the merits of particular technologies and outline potential geographic, economic, technical, or regulatory barriers.
- Faculty representatives, who can mention instructional concerns and recommend policies for faculty training and recognition.
- State agencies, including all those that could be providers or users of systems.
- Public broadcasting systems, many of which have extensive experience and capabilities in educational technology.
- Business and professional groups, which are often among the largest consumers of programs offered through technology.

Roles and Missions. State policies should identify roles and missions for each institution. In many cases, existing role and mission statements will need to be revised to reflect the uses of educational technology. While it is desirable to specify missions in ways that avoid unnecessary duplication, it is also important to encourage new initiatives by institutions. Thus, mission statements regarding educational technology should be flexible and able to accommodate new approaches.

Access and Equity. As noted earlier, many technologies can be used to broaden access to higher education. However, technology often cannot resolve access problems that stem from social or economic factors. If a state seeks to broaden access to higher education, policies regarding educational technology should identify specific approaches that can address these concerns. Moreover, the limitations of technology in providing access should be noted, and other policies should be developed to address these limitations.

Intrastate Cooperation and Coordination. State policies need to outline procedures for ensuring cooperation and coordination among state colleges and universities. Many technologies can best be used by groups of universities, and many other technologies can produce expensive duplication if purchased by several universities in the same state. Few states can afford to immediately provide each university with a satellite uplink and the necessary support facilities and staff, especially since few of these uplinks would be extensively used at first. State policymakers, working with representatives of each institution, should design approaches that facilitate joint governance of systems and sharing of facilities. Among the approaches that have been used successfully are:

- State control, in which all major technology systems are run by a state agency rather than an individual institution.
- Cooperatives, in which an independent group made up of all interested institutions owns and operates the systems.
- Advisory boards, in which a multi-institutional board governs a system, with direct operational responsibility in the hands of a single college or university.

Service Areas. As with roles and missions, educational technologies can have major impacts on institutional service areas. State policies should reflect these impacts. In some cases, it may be desirable to abolish service areas, at least for programs offered through technology. In other cases, service areas can be preserved with the understanding that any programs offered on a statewide basis must be administered by a group of institutions.

Quality Standards and Program Review. Programs offered through technology require new types of quality standards for program-review activities. These standards need to reflect three major considerations:

- Technical quality, including system performance and reliability.
- Instructional quality, including standards applied to regular instruction and new standards reflecting the unique features of technological programs.
- Effects on existing programs, including diversion of resources, increases in faculty workloads, and effects on on-campus students.

Financing. The use of educational technology raises many financial issues that should be addressed by state policies. Among these issues are:

- Cost recovery, particularly whether the full costs of a system must be paid for by the users. If so, it is important to specify a period for the recovery of the initial capital investment, since this is usually the most expensive part of any program using technology.
- State subsidy, particularly the extent to which state funds can be used to subsidize off-campus programs provided using technology.
- Fee structure, including whether programs that use technology can charge supplemental fees and whether such fees are controlled by the program, institution, or state.

These financing issues can be addressed in many ways. The simplest policy is to judge all courses equally, regardless of location or the use of technology. Fee structures and subsidies would be identical for all programs. A modification of this approach is to charge regular tuition for all courses offered at educational facilities, and also charge students at homes or businesses for any incremental costs involved in distributing courses to these locations. A third policy is to charge students in programs offered through technology the full operational cost of the program, with or without amortized capital costs. A final approach is a market-based policy based on the ability or willingness to pay. Under this policy, engineers at industrial locations would likely pay more than teachers or homemakers. Each of these approaches is being tried in at least a few locations throughout the U.S., and some states have examples of all four policies.

Faculty Training and Instructional Development. If educational technology is to be an important component of a state educational plan, provisions must be made to train faculty in the use of technology. It may also be desirable to provide incentives for faculty to use technology, including training grants, salary supplements, or recognition in tenure and promotion decisions. Depending on the types of technology to be used, state policies should include provisions of this type.

Integration of Voice, Data, and Video. In most states, systems for voice, data, and video transmission have developed independently and are often operated by different groups within an institution or state agency. In the past, differences in technologies encouraged such divisions of

responsibility. Now, however, the needs of such systems often overlap, and duplication can easily occur. Furthermore, many new technologies can be used cooperatively for voice, data, and video purposes. Thus, state educational technology plans should identify current responsibilities and propose changes in structures, policies, or responsibilities that will ensure greater cooperation among voice, data, and video systems.

Cooperation with Other Users. Many other groups also make use of information technologies, and state technology policies should encourage cooperation with these groups. Among the groups that should be included are K-12 schools, vocational schools, private universities, libraries, and other state agencies responsible for technology. In developing technology policies for higher education, state agencies should work with these groups to assess possibilities for cooperation and joint use of systems. Such multiple use can avoid duplication, generate more revenue, and increase success in seeking outside funding.

Interstate Cooperation. State technology plans should also assess the potential for interstate cooperation in developing and using systems. Several successful interstate ventures are already under way, such as a microwave link between the University of Idaho and Washington State University, and a similar link being built between Colorado State University and the University of Wyoming. Interstate cooperation often provides access to more programs at lower costs. In particular, state technology plans should consider the possibilities for expanding existing interstate agreements (such as those for reciprocal tuition) to include new technologies.

Implementation

The development and implementation of a state educational technology policy is often a difficult and frustrating task. The diverse nature of issues to be addressed, the rapid evolution of technology, and the large number of interested groups makes it hard to start, let alone complete, a state technology plan. However, several states have carried out considerable work in this area, and their experiences provide valuable guidance. Most successful efforts to develop technology plans have included five steps.

1. *Identify current needs and uses.* Before a plan can be prepared, information about the needs to be addressed should be gathered. This information is usually found in existing state policy documents and can be supplemented with surveys or interviews with state officials, educators, and private groups. In addition, information should be gathered about current uses of educational technology in the state, including the higher education and K-12 systems. Other users of related technologies, such as libraries and state agencies, should also be included.

2. *Collect recommendations from interested parties.* All groups interested in educational technology should be asked to provide input to a state plan. In many cases, these individuals identify needs and options that are often overlooked at the state level. For example, many users of technology identify faculty training as a critical component of a technology plan, but most plans developed solely at the state level fail to include provisions in this area. Once the ideas are submitted, they should be collated and circulated to all of the parties for comment. Broad involvement at this stage is very desirable, since it builds support for the overall plan and ensures that more opinions are considered.

3. *Review activities in other states and carry out external evaluations.* Many lessons can be learned from the experiences of other states, so contacts with these states and national organizations are often valuable. It is especially important to discuss the issues with representatives of neighboring states as a way to identify the potential for interstate cooperation. It is also desirable to obtain external review of existing systems and proposed policies.

4. *Educate key policymakers and institutional leaders.* Contacts should be made with important decisionmakers to increase their awareness of the uses and importance of educational technology. Most state efforts to encourage the use of technology have succeeded because of the commitment of top officials, including governors, legislators, governing board members, and college and university presidents. In Indiana, for example, the statewide higher education telecommunications system was developed with the active involvement and support of the governor and lieutenant governor.

5. *Develop policies.* Once recommendations have been collected and a base of support established, the final set of policies can be developed. These policies should reflect the particular needs of the state and should be flexible enough to accommodate new technologies and changing conditions.

Summary

Technology will produce changes in the activities and operations of institutions of higher education. As a result, state agencies need to develop policies governing the use, control, operation, and funding of technological systems. These policies should be closely integrated with assessments of educational needs, and should be developed with the broadest possible input from individuals inside and outside the higher education system. In addition, successful implementation of these policies usually requires active involvement and support from senior policymakers. □

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FINANCE ISSUES IN THE TELECOMMUNICATIONS AGE

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Michael B. Goldstein
Suzanne H. Woolsey

THE NEW telecommunications technologies impose two separate sets of financial burdens on states and institutions: the initial costs of acquiring the telecommunications equipment and related facilities, and the ongoing costs of their operation. Often, when an institution plans for new technologies, serious consideration is given to capital costs (facilities and equipment) and relatively little concern is raised—at the outset—over added operating costs. Indeed, it is often assumed that after the initial capital costs are defrayed and the equipment is installed and operational, the operating costs of telecommunications-based instruction and similar institutional uses of the new technologies are relatively minor. Too little attention is paid to the considerable costs that attend the day-to-day operation of telecommunications-based systems, or to what inevitably becomes the compelling need to replace today's state-of-the-art equipment with tomorrow's advances. It is commonly assumed, for example, that the operating costs of technologically advanced instructional systems are relatively minor, in comparison to "traditional" forms of instruction. The discovery that these assumptions are not necessarily correct has given rise to situations where there is an abundance of facilities and equipment and a severe shortage of qualified personnel to operate it! Clearly, any discussion of financing of higher education in the telecommunications age must consider both the capital and the operating costs of such systems.

This chapter explains both traditional and innovative approaches to financing the capital and operating costs of integrating technology-based programs into institutions of higher education. Issues such as retaining revenues from technology-based programs and ensuring access to equitable student aid for technology-based programs are addressed. Additionally, this chapter explains the advantages and disadvantages of state appropriations for equipment, as well as long-term debt financing, joint ventures, leases, and government grants.

Financing Operations

Public and independent institutions of higher education have generally taken different approaches to financing their operations. For the former, the primary funding source has been direct state appropriations; while for the latter, it has been tuition, gifts, and income from endowment and other sources. Over the years, however, as both public and independent institutions have become more complex and the cost of operations has increased, the two approaches to financing have become more alike. There has been an increase in state involvement and public subsidy in the private sector, and a broadening of revenue sources (including private gifts and contracts), as well as an increased reliance on tuition in the public sector. Nevertheless, public university decisionmaking remains modeled on formula funding and the state appropriations process, while private sector decisionmaking continues to be founded on tuition revenues and the development process.

The costs of operating telecommunications systems are stimulating new thinking about raising revenues and creating new interest in a broad range of alternatives at the institutional and state levels. In the private sector, there is willingness to work with other institutions—public as well as independent—to share facilities and personnel. There is also eagerness to share in the largess that a state makes available when services are extended via telecommunications to previously unserved or underserved clienteles. However, it is in the public sector where the telecommunications age is having the greatest impact upon institutional financing.

New technologies have forced many states and institutions to change the ways they account for instructional costs. Faculty-student ratios and their relationship to institutional income and expenditure calculations have been disrupted by instructional delivery systems whose operating costs bear little or no relationship to such factors. While the income derived from a technology-based delivery system might be correlated to the students enrolled in it, the cost of operating such a system might not be. The seductive cost-benefit argument of telecommunications-based instruction is that it should cost essentially the same to reach 10,000 persons as it does to reach 10. And, in fact, the cost relationships are not linear. Serving 10,000 students via telecommunications is not going to be 1,000 times more costly

than serving 10. However, the cost of serving the first 10 is likely to be dauntingly higher than conventional classroom instruction.

The number of people required to create and teach telecommunications-based programs differs from that needed in traditional institutional programs. Moreover, people with different skills and experience levels are needed, with more emphasis on production and technical backgrounds, and less upon a cadre of lecturers. Such personnel differences impose new demands on management with respect to compensation schedules and promotional patterns. This, in turn, creates new financial pressures.

Finally, the capital-intensive character of the new technologies imposes upon the operations of the institution the cost of paying off the debt incurred to acquire the facilities in the first place, as well as the necessity for creating reserves to replace and upgrade obsolete or worn-out equipment. As revenue bonds replace the general obligations of the states, and as alternative financing mechanisms create commitments to partners and joint venturers, new demands are being made on income derived from these efforts and on general revenues of the institutions and states.

The characteristics of formula funding, the ability of institutions to retain and control the revenues generated by their technology-based programs, and access to adequate financial assistance for students utilizing such resources are particularly thorny issues.

Formula Funding and the New Technologies

The concept of formula funding in higher education is straightforward. It is based on the assumption that a certain full-time-equivalent (fte) enrollment or generation of credit hours requires a particular level of funding. No state uses a system that allocates funds solely on the basis of overall enrollment or credit hours; rather, considerations such as the nature of the academic program (including factors such as the high cost of providing laboratory courses) and the nature of the student body (including factors such as the special costs arising out of institutional commitments to remediation) are regularly incorporated into formula-funding equations. But when the cost of the institutional system bears little or no relationship to enrollments—as is the case with telecommunications-based instruction—the formula-based allocation process collapses. In states with enrollment-driven, formula-based allocation systems for public higher education, much needs to be done to accommodate the formula to the actual costs of delivery. The same is true in states that provide enrollment-driven grants to independent institutions.

Some states have set up a finance model for telecourses offered by their public institutions that is intended to tie the state-support formula to the actual cost of instruction. However, these efforts are bedeviled by a lack of information on the overall costs involved. For example, most systems

factor in the cost of instructional personnel. They do not include the costs of instructional materials (purchase or licensing of telecourses) or the people who review, support, and transmit them because, in the traditional model, these costs do not exist: textbooks are purchased by students out of their own resources, and the only time that student costs appear in institutional financing is in the calculation of financial aid.

Another unknown is the most appropriate level of support services for students served through telecommunications. While it is clear that one instructor cannot adequately serve the interests of 500 students enrolled in a television class, is the proper support level one instructor and five assistants, or some other combination? Much depends on the nature of the technology: a course that includes computer conferencing might require very different support than one which requires monthly meetings. Another factor usually overlooked is utility costs, particularly interconnection fees and line charges, which, especially after the breakup of AT&T, have tended to fluctuate significantly.

Finally, technology-based programs are very dependent upon rather short cycles of equipment and facilities replacement and upgrading. Nonetheless, funding formulas, to the extent that they incorporate a replacement reserve at all, tend to compute the reserve on a far longer schedule of obsolescence. Determining the appropriate funding base—assuming the retention of formula funding—is a major task for state agencies charged with the oversight and management of higher education. Even the alternative—cost-driven budgeting—suffers from many of the same deficiencies, since institutional, state, and legislative budget offices often lack the necessary knowledge and experience to assess the requirements of telecommunications-driven systems.

Retaining Revenues from Technology-Based Programs

The second major operational financing problem facing higher education in the telecommunications age involves the ability of institutions to keep the revenues generated by technology-based programs. In quite a few states, tuition and fee revenues do not flow back to the institution, but rather into the state's general fund. The appropriations process is thus technically removed from the revenue stream. Creating special user fees or other revenue sources for students enrolled in learning programs via telecommunications holds no benefit to the institutions if the additional revenues generated by such charges do not accrue to it.

The converse of this problem also exists. Many telecommunications-based programs are defined as lying outside the regular academic program of the institution. By placing the long-distance learning program in the same category as traditional extension and continuing education activities, the revenues might not have to go back to the general fund. Rather, they

could go into a revolving fund that is accessible to the institution to support these programs. However, the problem is that many states require that such programs be supported entirely through revolving fund revenues. This requirement may be manageable for established extension centers, but such arrangements are unlikely to generate the kinds of revenues needed to sustain a technology-based program, unless the fees are so high that only the most affluent can afford them.

There is another side to the issue of funneling income into a revolving fund. Some institutions have redirected these revenues for capital purposes to fund replacement reserves, for example, or to develop new facilities. Given the difficulty of obtaining capital funds, it is prudent management to use the revenue stream to support capital expenditures, particularly to fund a replacement reserve. But when funds needed for personnel are used for equipment, the program is literally feeding upon itself. This internal conflict is exacerbated by state policies that force the institution to find its own funds for services and facilities which, if other than telecommunications, would likely be within an institution's base budget.

The New Technologies and Student Aid

Until the enactment of the Higher Education Amendments of 1986, students had to be enrolled on at least a half-time basis in order to be eligible to receive federally-subsidized financial assistance, regardless of need. Furthermore, the cost of instruction used in calculating need was limited to tuition, fees, and an allowance for books, supplies, transportation, and living expenses. The special costs associated with telecommunications-based instruction were not explicitly recognized, and therefore were often excluded from student-aid computations.

The 1986 Amendments not only extend access to student aid to less-than-half-time students (a significant proportion of those engaged in telecommunications-based programs), but also recognize an appropriate cost of attendance incurred for the rental or purchase of any equipment required for the conduct of the program. For the first time, the law forbids discrimination against students on the basis of the form of instruction, particularly forbidding imposing limits on aid because a student is enrolled in a telecommunications-based program.

While the changes in federal law do not necessarily mean that state student aid programs will be amended accordingly, it has been customary for the states to follow the general outline of the federal law. These changes should affect the way both states and institutions look at the financing of technology-based programs. Access to equitable student aid should mean that a new cohort of students can take advantage of program offerings. In turn, the tuition generated through such enrollments should produce more operating revenues for creation and operation of the programs.

Financing Equipment

If financing the operating costs of higher education in the telecommunications age is difficult, finding ways to defray the substantial capital costs is even more complex. The need to consider capital equipment purchases independent of the cost of construction of new facilities is a relatively recent phenomenon. Until the mid-1960s, most institutions were reasonably able to assume that the useful life of new buildings and the new equipment installed in them would be roughly the same. In the last two decades, however, it has become increasingly apparent that the useful life of much of the high technology needed to run a modern university—notably telecommunications, computational and research instrumentation equipment—has been decreasing dramatically with the continuing surge of technical innovation.

Colleges, universities, and the states that finance them thus find themselves in a quandary. On one hand, traditional financing mechanisms that assumed 20- to 30-year lives are of decreasing utility. At the same time, the necessity for more frequent equipment replacement and upgrading continues, shortening even further the time between acquisition and replacement. The need to replace equipment more frequently than the buildings in which they are housed has made it necessary to contemplate new procedures at the state and university levels for setting priorities, making decisions, and identifying new means of financing these more frequent and more costly acquisitions.

The problems created by the increased cost and decreased useful life of equipment have been compounded by a variety of other factors unique to telecommunications and other high technology. These include the following problems and issues:

- A growing array of technically feasible options, each with widely different capabilities and disparate price tags, is now available. For example, states and institutions no longer have the single option of a wired system to provide voice and data transmission. Fiber optics, microwave, and even satellite systems must also be considered.
- The rapidity of technological change is making it increasingly difficult to determine the best time to purchase technology, especially because state and institutional procurement processes are so cumbersome. A system that appears adequate when it is first specified can well be virtually obsolete when finally installed.
- The traditional maxim that costs rise over time does not necessarily pertain to telecommunications technologies, particularly when computer equipment is involved. Yesterday's $1 million mainframe is today's $50,000 mini and tomorrow's $5,000 micro.

- Conversely, the enormous costs of major systems, such as supercomputers or fully equipped video facilities, often compel cooperation between institutions and stimulate the creation of statewide and regional mechanisms for their financing and operation.

- The range of financial mechanisms and the degree to which each places a burden on present and future resources of the institution and the state have radically expanded over the past decade, particularly since the 1981 and 1982 changes in tax law. Debt financing for high-technology equipment grew in response to interest by investors in innovative tax-exempt issues and in response to problems faced by many states and individual institutions when they attempted to finance acquisitions within their general budgets. The effects of the 1986 Tax Reform Act, while still unclear, are likely to cause further changes in financing approaches and alternatives.

- The need to acquire complex telecommunications systems, along with research instrumentation and other high-cost, quickly obsolescent equipment has made it difficult for many institutions, particularly those in the public sector, to stay within the limitations imposed by state law and procurement policies. Centralized procurement systems, put in place decades ago to streamline state government and root out inefficient and sometimes corrupt practices, along with rigid limitations on multi-year contracts, are today frequently unable to handle the unique aspects of acquiring telecommunications systems. At the same time, debt limitations imposed by states and the restrictions imposed by the Tax Reform Act of 1986 are likely to impede some forms of financial support by the states.

- The nature of telecommunications systems runs counter to the concept of the self-contained campus. The technological capacity to link institutions and extend access directly to the workplace and the home tends to change the locus of decisionmaking from the university to the state.

States and institutions have responded to the above challenges in a variety of innovative ways. While the choice of system and the determination of the appropriate moment to acquire a system continue to stretch the imagination and skills of managers and planners, there has been a rapid increase in the number of new approaches that address the financial aspects of such purchases. Increasingly, states and institutions are using non-profit and for-profit subsidiary corporations; creating joint ventures with other institutions, agencies, and states, as well as with the commercial sector; devising certificates of participation and other non-traditional methods for

raising funds; and merging public and private financial resources to create the critical mass necessary to acquire the needed equipment. An increasing number of states are also striving to consolidate major telecommunications systems and capabilities by entirely removing the burden from individual institutions or by spreading the burden among several institutions. While the approaches vary, it is clear that if institutions are to meet their telecommunications needs and if states are to ensure that their institutions have available the capabilities necessary to carry out their missions, they must make use of such innovative approaches.

In recent years, new ways to pay for the acquisition and replacement costs of telecommunications technology have created a wide range of debt-financing, contractual, and development approaches. In planning for the acquisition of telecommunications equipment and the facilities in which to house it, an institution or state agency should consider the following available financing options: government (primarily federal) grants; state appropriations; long-term debt (primarily in the form of bond issues); short-term debt (primarily in the form of bank loans or vendor financing); joint ventures (with other institutions, other governmental or non-profit entities, the commercial sector, or a combination thereof); leases and other vendor relationships; and capital fund-raising.

Because state appropriations, long-term debt financing, joint ventures, leasing, and government grants involve a number of new approaches or exhibit special characteristics when applied to telecommunications technologies, each option is discussed in some detail.

State Appropriations

The largest single source of funds for postsecondary education is the states. Typically, funds for operating public institutions are appropriated separately from those intended for purchase of equipment and construction of buildings. Often, the former are appropriated on a regular cycle of one or two fiscal years and include the cost of acquiring relatively inexpensive equipment. Rarely, however, can operating funds be used to finance significant equipment needs or even to replace existing major equipment. Moreover, it is difficult to ensure that the funds appropriated in the operating budget will be sufficient for the operations and maintenance of complex telecommunications equipment, or for the personnel necessary to make full use of the technological capabilities.

There is also the problem of convincing legislative committees of the true operating costs of state-of-the-art technologies. In the best of times, it is not easy to obtain adequate financial support from the legislature for operating high-technology systems. At a time when some states are cutting back appropriations, it is often very difficult to obtain sufficient funds to

maintain and operate telecommunications facilities. As a result, there is around the country an increasing number of instructional telecommunications systems whose operations have been curtailed or discontinued because they are viewed as peripheral to the mission of the institution.

This problem is most serious in those states where institutions are financed on a rigid formula basis. The personnel requirements and costs attendant upon technology-based systems can be dramatically different from those arising out of traditional modes of instruction, research, or public service. A budgeting system that allocates one instructional position for a certain number of full-time-equivalent enrollments or credit hours generated cannot account for the differential costs and personnel requirements of telecommunications systems. Few institutions and even fewer states have developed planning and budgeting models that fully account for the different operating costs of telecommunications-based delivery systems. Thus, those costs tend to be treated as an exception, rather than being integrated into the base-budgeting mechanism. This practice can result in funding that is generous at the outset but then becomes inadequate by the end of the project. Because operating costs tend to increase as systems age and come under heavier use, this is a particularly serious problem.

Equipment acquisitions at public colleges and universities are usually financed through a state's capital budget, and in some states capital facilities are provided independent institutions through this same route. Unlike the operating budget which is funded out of current revenues, a state's capital budget is limited not only by the present and anticipated ability of the state to finance the capital cost (that is, either direct acquisition costs or the cost to service the resultant debt when borrowed funds are used), but also by how close prior debt has brought the state to its statutory debt limitation. A state that has in recent years embarked on major programs to improve its infrastructure, or is experiencing competing capital needs such as for roads or prisons, might find itself with little ability to acquire new facilities and equipment for higher education.

Added to these economic limitations is the inherent slowness in most states' capital-financing processes that can delay a facilities project for years. Such delay can prove fatal to the development of a telecommunications system: technological change may render the proposed system obsolete, while state laws and policies can make it exceedingly difficult to reprogram the request to accommodate the changed circumstances. The result is the purchase of equipment that is obsolete before it is even installed. Coordination at the state level regarding the time-sensitive nature of technological systems and responsive legislative and budget processes are,

therefore, essential for efficient state financing of telecommunications equipment.

Further exacerbating the problems arising out of direct state financing are state controls regarding how capital equipment can be acquired and used. The regulations are intended to promote good management and prevent fraud and abuse, and they generally apply to all state agencies. While simply irritating for some routine purchases, the procedures can add costs as well as delays to the acquisition of any relatively sophisticated equipment. Requirements for competitive procurement, coupled with mandatory review by a central purchasing agency and, even more intrusive, requiring that equipment must be purchased from an approved list, can effectively prevent an institution from acquiring the equipment that it needs.

Most of the existing state controls on telecommunications and computing equipment are based on the reasonable goal of standardizing acquisitions and systems. However, attempting to standardize instructional telecommunications systems can stifle innovation. While an increasing number of states are lifting some of the most onerous restrictions regarding state procurement policies for equipment acquisitions, this relief tends to be concentrated on the acquisition of scientific research instrumentation. Thus, while some telecommunications equipment is exempted in some cases, more often it remains within the circumscribed procurement process.

The question of title to state-funded equipment can raise problems with respect to telecommunications equipment. This is because telecommunications equipment is particularly suited to joint use between the institution and other, particularly private sector, users. State law can sharply circumscribe the ability of an institution to allow state-funded equipment to be used for other than public purposes, a limitation that can obviate a number of attractive ways to support ongoing operating costs.

A further problem arises out of complaints from some sectors of the business community that public institutions and other tax-exempt institutions such as independent colleges are taking advantage of their status to compete unfairly with the for-profit sector. Such charges can derail the part-time use of state-funded facilities for other than public purposes, such as the commercial use of a television-production facility to help defray high operating costs. And the charge that state-funded equipment is being used to compete with private businesses—even if not proscribed by law—can also bring down the wrath of the legislature, thereby jeopardizing future funding. The promulgation of clear guidelines for non-public use of such facilities is essential to avoid costly misunderstandings, as well as to stay within the letter of the law.

The great advantage of funding telecommunications equipment through state appropriations is simple: the money does not have to be repaid. Even if the source of the funds is a state bond issue, if it is an obligation of the state, the cost of servicing the bonds legally falls upon the entire state government and not the recipient of the funds. However, some states have developed the more sophisticated approach of charging agencies for their share of the servicing costs of capital debt. When this is more than a mere paper allocation—as is often the case with replacement reserves that serve to dramatize the need to replace equipment—the burden upon the operating budget of an institution can be severe. If the institution is funded by formulas, and if the telecommunications facility also imposes increased personnel burdens, the obligation to service the resultant debt may strain the institution's resource base.

Long-Term Debt Financing

States, colleges and universities have increasingly turned to other forms of long-term debt to finance large capital expenses, including major instructional and administrative telecommunications systems. There are several advantages of using long-term debt. The borrower gets the immediate benefit of the principal sum, while having to budget a relatively small fraction of that amount on an annual basis to service the interest payments and amortization of the principal. Although over a period of from 10 to 30 years the amount paid back will be substantially more than the amount borrowed, the annual impact is far more manageable. Of course, as noted above, states and institutions can accumulate enough debt so that the required annual principal and interest payments could seriously limit other uses of available current funds, notably for personnel and general operating costs. Thus, great care must be exercised to determine which projects will be debt financed, and how that financing will be accomplished.

The servicing of long-term debt (that is, annual payments of interest and principal) can come out of either general institutional funds or an identified revenue stream, such as rents or fees received through the use of the facility. The latter can be a seductively attractive approach, particularly if the advocates of the project paint a rosy picture of the dollars which the equipment is going to generate. Unfortunately, while bondholders like to receive their payments regularly, disruptions in revenue streams are not uncommon. Perhaps the most striking example arose out of the debt financing of a supercomputer. In that case, an institution issued bonds on the strength of what it thought was a binding agreement with a commercial concern to lease a substantial amount of time on the machine. The revenues from the lease would have paid for much of the operating costs of the facility, as well as a substantial portion of the annual interest and principal

payments on the debt. Unfortunately, after the supercomputer was acquired and installed, the commercial user, faced with a change in market conditions, backed away from what its lawyers determined to be no more than a non-binding expression of interest. The potential revenue stream vanished, and the public institution had to beg the legislature for relief.

To a certain extent, problems such as these are less likely to occur since passage of the 1986 Tax Reform Act. Unfortunately, the outcome is not what one would desire. The new Act significantly limits the degree to which facilities financed through tax-exempt bonds can be used for other than governmental purposes (in the case of state institutions) or related non-profit purposes (in the case of independent colleges). States must also be aware that, for facilities financed with tax-exempt bonds issued after the effective date of the 1986 Act, the prohibition against all but minimal non-public use continues so long as the bonds are outstanding. Thus, a telecommunications center built with the proceeds of a tax-exempt bond issue will probably carry with it a 30- or 40-year restriction on use of the facility for other than public purposes. To make matters even more complex, the Internal Revenue Service has yet to rule on just where "public purpose" ends and "private purpose" begins, a particularly thorny problem for telecommunications and other high-technology systems and facilities. With these limitations in place, states and institutions need to explore other than tax-exempt financing when there is a strong possibility of profitable joint use.

Another concern arises out of the inherent uncertainty in revenue streams. Bond issues not backed by the full faith and credit of a state require a solid credit rating to elicit adequate investor interest. While this is not a problem for the largest and most affluent institutions, it can prove fatal for less well-off institutions. Such an institution might be required to incur significant additional costs to obtain bond insurance or a standby letter of credit, which is an irrevocable commitment by a bank to step in and pay off the bondholders if the institution should default on its obligations. Even so, there are many institutions that cannot obtain or afford bond insurance or obtain a letter of credit. To alleviate this problem and, to some degree, make up for the lack of direct federal support for facilities and equipment, Congress has created the College Construction Loan Insurance Association as part of the Higher Education Amendments of 1986. "Connie Lee," as it has come to be known, would insure the long-term debt of the middle range of colleges and universities that up to now have been excluded from the bond market because they are unable to obtain appropriate credit support.

Another way to deal with the inability of an individual institution to achieve an adequate credit rating is through "pooled debt financing." The

obligations of a number of institutions are pooled, and together they have sufficient wherewithal to satisfy investor confidence. It should be kept in mind that the 1986 Tax Reform Act limits the flexibility of pooled debt by requiring, for example, that projects be identified at the time of issue or be subject to certain penalties. Nonetheless, this approach is particularly attractive when each institution's needs are relatively modest. This is an important arena for aggressive state action, since establishing the appropriate mechanisms for pooled-bond issues generally requires specific legislative authority. A number of states have created such pools, in some cases specifically to finance research instrumentation, computers, and telecommunications facilities. These state-organized efforts not only create economic opportunity for institutions that would otherwise be deprived of such financing opportunities, but they also offer a strong incentive to coordinate and integrate high-technology systems on a statewide basis.

Debt financing of telecommunications facilities in the public sector may be limited, however, by the common statutory requirement that bonded debt be used only for buildings and contemporaneously acquired facilities. The re-equipping of an instructional television station, for example, might not qualify for bond financing by the state, even though the cost of re-equipping could be more than the cost of the building. Even if facilities are acquired along with a new building, a problem arises when the former require replacement long before the latter. State officials are often reluctant to consider replacing equipment purchased on a 30-year basis after only a few years have gone by. Legislators and budget directors need to understand that replacement cycles for technology-based instructional equipment are relatively short.

Joint Ventures

Colleges and universities generally have the legal capacity to enter into agreements with other entities, including sister institutions, other public or non-profit organizations, and commercial entities to carry out various activities. Such joint ventures have gained attention as a way to finance and operate telecommunications facilities. There are many advantages to such an approach: it broadens the equity base; if a commercial partner is involved, joint ventures can create funds for capital equipment; and if other public or non-profit organizations are involved, joint ventures can broaden the use of the facility. This, in turn, may make the project more attractive to the state with respect to financing, and may also generate revenues that can be used to cover operating costs and amortize the debt.

A variety of structures have been developed to enable colleges and universities to enter joint-venture arrangements. Most common is the creation of a subsidiary corporation or partnership (either for-profit or

non-profit) which is jointly owned by the university and its co-venturers. This is fairly easy to do at private institutions, but has raised problems for public institutions in states that limit the ability of the institution to be a co-venturer. In an increasing number of cases, this limitation has been circumvented by creating another entity, usually a non-profit corporation that establishes the legal relationship with the joint venture. An intervening entity is also useful in that it can limit the liability of the institution, an important factor that can convince state authorities of the prudence of the activity.

Joint ventures can also be less formal. For example, an institution can lease channel time on its telecommunications system to another institution or to a commercial entity. An excellent example is the decision by the Federal Communications Commission allowing institutional licensees of instructional television fixed service (ITFS) facilities to enter into agreements with commercial multipoint distribution system (MDS) operators. While there has been considerable debate as to the prudence of the agreements offered by some commercial operators, the general trend is for the private operator to generate capital to construct the facility in return for use of spectrum space for commercial operations. The university gets the facility with little or no capital outlay, and it also benefits by receiving a share of the income of the commercial operator. Like any commercial venture, however, the terms of the agreement must be very carefully negotiated to ensure that the institution is getting good value in exchange for granting prized channel space. It is also important to ascertain whether revenues derived from leasing channels remain with the institution so that it can finance operations of the facilities. In some states, such revenues must be returned to the general fund, out of which they must be reappropriated before the institution can make use of them.

Similarly, an institution or state agency might offer other public agencies and institutions use of its facilities in return for a share of the operating costs. This is the simplest type of joint venture, and the least difficult to create. An example of one such system can be found in Oklahoma, where the state agency of higher education has been funded partly by direct appropriations, partly through bonded debt, and partly by foundation grants to develop a voice, data, and video microwave system across the state that will interconnect all public institutions. Because the system is being designed with capacity over and above that needed for the institutions' purposes, other state agencies will contract to use the communication capacity that the system will afford.

Leases and Other Vendor Relationships

States and institutions can finance their acquisition of telecommunications facilities through innovative negotiations with vendors. Among

the options available are leasing, certificates of participation, and municipal leases.[1]

Leasing is a customary way of spreading out payments for equipment. However, interest charges for a leasing contract are often several points above the prime rate, and the vendor is less likely to discount the price if a lease is involved. On the positive side, lease payments for equipment are generally considered to be operating expenses and, as such, can be charged against an institution's current budget. Unfortunately, such an approach may be the only way to acquire costly equipment, particularly if debt financing is sharply limited by state law or by lack of credit worthiness.[2]

Access to this source of financing is not uniform. Some states still entirely forbid or sharply restrict leases that extend across an appropriations period. The alternative of an annually renewable lease is not particularly desirable, since when the lessor is not assured of renewal, the cost is even higher. Some institutions have used the device of leasing equipment through their foundation or other subsidiary to avoid this limitation, and in the public sector the vehicle of the municipal lease has similarly been utilized.[3]

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[1]Certificates of participation (CPs) are a relatively new debt instrument that was developed in response to the need of public institutions to lease costly equipment and facilities. CPs allow access to the equivalent of long term debt, but legally do not constitute long term indebtedness. A CP is similar to a lease purchase agreement, but with several investors acting as the lessor. Because of their complexity, CPs are generally economical only for equipment that costs more than $1 million, and generally are contemplated only when other avenues of financing are unavailable.

[2]The benefits commonly attributed to leasing are primarily available in a tax oriented lease in which the lessor retains and claims the tax benefit of ownership. Such a lease, referred to as a "true lease" for tax purposes, generally must qualify as an operating, as opposed to a capital, lease. (As in most tax law issues, the distinction is neither perfectly clear nor absolute; some capital leases in fact do qualify as "true leases.") An operating lease is defined as a lease under which the lessee (the institution) acquires the use of the equipment for a fraction of its useful life. Title to the equipment is retained by the lessor, and the lease does not contain an option to purchase the equipment at its expiration. The lessor may also provide services in connection with the equipment, such as maintenance and insurance. A capital lease, on the other hand, contains at least one of the following four elements: (1) title is transferred to the lessee at the end of the lease term; (2) the lease contains a bargain purchase option; (3) the lease term is at least 75 percent of the useful life of the leased property; (4) the present value of the lease payments is at least 90 percent of the leased property's fair market value, less certain tax credit adjustments.

[3]Municipal leases (which are only available to public institutions) offer a number of significant benefits, including: the institution receives title to the equipment for a nominal fee at the end of the lease term; there is no requirement for down payment; interest and principal payments are clearly defined; the lessor receives none of the tax benefits of ownership, but the interest payments are tax exempt; and the lease is usually on a fiscal year basis with renewal options.

Municipal leases allow a public university to enter into a lease purchase agreement and still meet statutory constraints on the incurring of multi year debt. Because of the tax exempt nature of the interest payments, municipal leases are usually priced at from 80 to 90 percent

Sale/leaseback arrangements, which became popular in the early 1980s due to the tax advantages they accrued, have been practically eliminated for public and non-profit private institutions as a result of changes in the tax laws that began a few years ago and culminated in the 1986 Tax Reform Act. Sale/leasebacks in which equipment or facilities are used by a tax-exempt entity have lost most of their tax benefits, making them relatively unattractive to private investors who, only a few years ago, clamored to buy into such transactions.

Government Grants

In recent years, federal funds for capital acquisitions have been limited to research equipment, with minimal support for instructional or administrative acquisitions. The programs that do exist are very small, very specialized, and extraordinarily competitive. Except for instrumentation acquired for defense-related research and development, the flow of federal grants and contract funds is likely to remain sharply constricted for some time to come. Certainly Congress' recent action reauthorizing the Higher Education Act of 1965 clarifies the priorities with respect to equipment acquisitions: virtually no money is authorized for capital equipment.[4] However, there is a new program to facilitate private borrowing in order to acquire equipment and facilities and a "Star Schools" initiative that includes a facilities component.[5]

Another problem with government grants and contracts is that they generally do not pay the full costs of a capital program. The costs of renovation of facilities to accommodate the equipment and, in the case of grants, the costs of operations and maintenance are typically excluded from the sums made available by the government. Moreover, while the costs of equipment have risen, grant awards have not tended to follow suit. This is a result of the need to assure a reasonably widespread distribution of federal largess. Since funds usually cannot be accumulated across fiscal years, gathering support to acquire expensive equipment is extremely difficult.[6]

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of the prime rate. Also, the ability to cancel on a year to year basis protects the institution from being saddled with continuing payments on technologically obsolete equipment.

[4]The Fiscal 1988 budget submitted by the President to the Congress goes even further in seeking to reduce funding for facilities and equipment, proposing to eliminate most of the few remaining sources of such funds.

[5]The "Star School" bill, S. 778, was introduced March 1987 by U.S. Senator Edward Kennedy and, as proposed, would provide $100 million over five years for the development of telecommunications networks for educational programs.

[6]One program, the Public Telecommunications Facilities Program (PTFP), actually encourages applicants to segment their projects on a multi year basis, so that annual appropriations can be distributed more widely. No obligation to fund subsequent years is made, however, and problems have arisen when phase one is funded but phase two is not. And worse problems

Some institutions have found an ingenious way to solve this problem. Because it is Congress that appropriates funds for each of the federal programs, it is also Congress that can direct how the funds are spent. An institution whose state senator or congressman wields power in the right committee can find itself the beneficiary of a "set-aside," a specific sum of money granted to an institution for a particular purpose. Despite political controversies surrounding the designations of set-asides, such designations continue to increase in frequency as well as amount. As federal funding becomes more scarce, pressure to resort to set-asides will doubtless increase. The state's role in this process is a particularly difficult one. The institution seeking a set-aside often needs the broadest support, and it is rare that a state official wants to be seen torpedoing funds for one of its schools. But the state coordinating or governing board may not see the request for set-aside as representing the greatest need among institutions, thus creating a conflict of priorities.

A final question with respect to federal funding is: Who owns the equipment? Whether or not the institution has title to equipment acquired with federal funds depends entirely on the funding program and the terms and conditions of the grant or contract awarding the support. Without assurance of title, states and institutions tend to be reluctant to combine their funds with those of a federal agency. This makes the use of other forms of financing in conjunction with federal support even more difficult.

Conclusion

The problems of financing higher education in the telecommunications age are not substantially different from what they have been in the past. However, the nature of the technology—particularly its cost and ability to transcend geographic and political boundaries—imposes rather different constraints and affords some unique opportunities. Telecommunications technology cries out for interinstitutional and interstate cooperation in facilities development and utilization of services. Likewise, the close relationship between the uses of high technology on campuses and in the business world makes joint ventures highly attractive options.

It is incumbent upon the states, which must oversee the development and use of these facilities and services, to consider the full range of financing alternatives presently available, as well as those that will become available in the future. States need to consider a number of issues:

- How can innovation be stimulated, given the constraints of economic reality?

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are possible: in at least one case, a public institution was compelled to retain funds for several years to enable it to accumulate enough state funds to allow the project to go forward, only to find the Federal agency demanding its grant back for alleged lapse of funds.

- How can the infusion of private capital be encouraged without running afoul of existing law or invoking the wrath of those who are already convinced that government in general and higher education in particular are unfairly invading the commercial marketplace?
- How can the desire for state-of-the-art technology be balanced with the need for skilled personnel who can manage and operate the systems that are already in place?
- How can territoriality and institutional egos be overcome so as to maximize the time-and-space crossing characteristics of the new technologies?
- How can the capital and operating costs attendant upon the new technologies be financed so that they are consistent with maintaining existing instructional, public service, and support systems?
- How can students be empowered to access the new technologies in the context of available financial assistance?

The role of the state in financing higher education in the telecommunications age remains unchanged. The state is the primary source of financing for the public sector, and it is an increasingly important source for independent institutions as well. It is the first-tier arbiter of quality and the storekeeper of access. The state must also carry out the difficult task of balancing the interests and needs of higher education against other interests and needs, in the context of what is best for the citizens of the state. This is a difficult task, made more so by the complexity and constant evolution of the telecommunications field. □

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THE ROLE OF THE FACULTY IN THE USE OF LEARNING TECHNOLOGIES

6

Patricia J. Dewees
Lee C. Frischknecht

ADMINISTRATORS, faculties, and staffs at institutions of higher education have successfully integrated electronic communication systems and services into administrative and research activities. However, they have not widely integrated the new technologies into teaching. Telecommunications will not be integrated into teaching until faculty and administrators develop the infrastructure and policies that make it advantageous for them to do so.

This chapter analyzes the structural factors that explain why the new learning technologies generally have not been integrated into teaching. Attitudes of faculty members toward technology-based programs and the faculty reward system are discussed. Some successful approaches to moving into the information age that have been undertaken by universities are then described.

Institutional Root Problems

Disinterest about the use of telecommunications technology for delivery of mainstream academic services stems largely from weak or nonexistent institutional infrastructures to administer such programs and services and from the lack of incentives for faculty, deans, and department chairpersons to offer courses via nontraditional systems. Faculty are reluctant to participate

in telecommunications programs when there are no comprehensive, faculty-approved policies and procedures outlining the conditions of their involvement. Lewis' (1985, p. 22) study for the Corporation for Public Broadcasting found that most faculty believe that technology-based instructional efforts "go unrewarded, and in some cases, even jeopardize career advancement by raising questions about the seriousness of the faculty member's commitment to research." Neither administrators nor faculty members are apt to invest their time and energy without prior resolution of issues pertaining to funding, accreditation, quality control, transfer of credits, collegiality, non-academic staff roles, and assignment of space on the telecommunications network. Faculty resistance is even greater to the offering of telecommunicated courses intended for nontraditional students in non-resident settings—an activity which is at the bottom of the reward list in four-year research institutions.

The Central Role of the Faculty

Faculty are expected to be experts, create new knowledge through research, and pass on the accumulated knowledge of their discipline through teaching. In American universities, faculty members are also expected to prepare the younger generation for their careers. Today's information revolution demands a redefinition of teaching and research. The new technologies make it possible to restructure the world of work and increase the organization and delivery of information.

Faculty are interested in research, teaching and learning, and not in technology per se. They are also interested in academic freedom, their intellectual property, their particular discipline, and their careers. The application of learning technologies to academic programs must therefore be carried out according to policies and procedures that are instituted and approved by instructors (Knapper, 1982).

While there have been small gains in the involvement of faculty in instructional television, a study carried out by the American Association of Higher Education (Lewis, 1983) found that the problem most commonly faced by postsecondary instructional media professionals was resistance by faculty to the use of telecommunications. Arms (1985) points out that educators tend to perceive electronic technology as an extension of their courses, but not as a replacement or alternative. In a more recent report (Lewis, 1985), current faculty attitudes are characterized as intensely critical of present instructional telecommunications and are guardedly optimistic about future possibilities. This report also noted that faculty view the instructional potential of computer, video, and audio technologies quite favorably. However, they are highly critical of most currently available instructional software materials, particularly computer software.

Two phenomena are altering attitudes of faculty towards high technology, particularly computers. The first is the fact that the tools—videocassette recorders (VCRs), videodisc players, microcomputers, and interactive telecommunications systems—are rapidly becoming essential for research and publishing. The expansion of electronic publishing and research communications networks complement, rather than oppose, the traditional system of academic work, thereby encouraging faculty to use the new technologies. Because virtually all books published in the last few years have been put into an electronic format for word processing before printing, colleges and universities must encourage faculty to develop new research and electronic publishing skills. This suggests the need for policies and programs of encouragement that build on the existing reward system.

Second, the fear of being left out of the frontiers of research will move scholars to experiment and learn the necessary skills. This is the case with microcomputers. Academics are much less resistant to the microcomputer because it is a research/writing tool that makes them more productive. As Tucker (1983, p. 18) points out, "Computers do not seem to threaten the core instructional technology or the structure of the institution. That is, they do not substitute for the teacher who is the core technology." Furthermore, the computer— especially the micro—is completely controlled by the faculty member and makes him or her more productive.

The Faculty Reward System

In academia, as in the military, there is an "up-or-out" system of promotion—the tenure track system. The factors that contribute to promotion, salary increases, and tenure generally do not include teaching via nontraditional techniques. Successful grants persons, researchers and writers are "rewarded" with reduced classroom teaching loads and increased staff assistance which, in turn, permit time for consulting opportunities, and research/writing. Clearly, teaching is less important in promotion/tenure decisions than research, securing grants, and publishing scholarly articles.

The few existing policies that reward faculty for involvement in non-campus-based instruction do so in the most conservative tradition. The University of Illinois (1981) has published a paper entitled, *A Faculty Guide for Relating Continuing Education and Public Service to the Promotion and Tenure Review Process.* These guidelines (University of Illinois, 1981, p. 1) attempt to incorporate into tenure criteria continuing education and public service: "Faculty outreach efforts are most highly valued when they demonstrate that the faculty member is 'at the leading edge' and making significant contributions to new knowledge in his or her discipline or profession . . . [Such] efforts contribute most to scholarly stature when they are: reported or cited in scholarly publications, shown to have impact

on public policy, or demonstrate innovative breakthroughs in linking theory with practice."

The research/grants/publication tenure track system is not the basis for promotion in undergraduate and community colleges where faculty are rewarded for teaching, developing innovative courses, delivering instruction to nontraditional students, and participating in a variety of community service activities. Furthermore, many of the outreach programs of undergraduate institutions are carried out by part-time, adjunct faculty who are not expected to meet the same standards as full-time faculty members of the institution. The emphasis on teaching leads to a higher use of technology-based courses in these institutions.

Faculty in tenure track modes must be judicious in the use of their time in order to ensure long-range rewards. The development of a mediated course or the offering of a pre-recorded course requires a considerably greater amount of a faculty member's time and energy for preparation, presentation, and administration than is normally necessary for traditional classroom instruction. Software development requires even more extensive time commitments.

One of the most effective ways educational administrators can support faculty is to acknowledge the extra work required to develop instruction for delivery via telecommunications systems and provide adequate released time for it. This is the strategy being used in computer literacy projects. PROJECT QUEST at The University of Texas at Austin, for example, illustrates how important it is that administrators support faculty members in their endeavors to transform education with computers. PROJECT QUEST is designed as an internal grant program. Faculty submit competing proposals which are funded by released time from other responsibilities plus full use of a computer and support staff.

More evidence on the value of adequate support services has come out of an Annenberg/CPB study (Blackburn and Ging, 1986) in which faculty members at institutions that were successful with telecourse offerings were interviewed. The study points out that "adopters" of telecourses expect more support from their institutions than "non-adopters." Adopters included administrators "expecting positive reactions to the courses from students, faculty, and department chairs" and faculty members "expecting administrative support for the offering of the courses" (Blackburn and Ging, 1986, p. 12-13). Clearly, faculty are willing to teach telecourses when there is support.

A study (Grasso, 1984) of the quality and effectiveness of West Virginia graduate programs offered on and off campus (including a mediated, award-winning MBA degree program) revealed that involvement is a critical component of faculty attitudes. Those who teach exclusively on campus

were likely to comment negatively on the quality of instruction in off-campus and mediated courses, while those who had participated in telecourses said they were comparable to on-campus courses (as did students participating in those courses).

The integration and increased interconnection between computers and telecommunications into a knowledge network promises faculty increased access to cutting-edge research and an expanded definition of collegiality. EDUCOM, a non-profit consortium of colleges, universities, and other institutions founded in 1964, is a good example of how information can be brought from all over the world to college campuses. Computer-to-computer research networks, electronic bulletin boards, electronic mail, and planning/software evaluation services link scholars from over 500 institutions in the U.S. and abroad. EDUCOM provides access to huge data bases that are critical for research, and it creates inexpensive opportunities for conferencing among scholars. Because teleconferencing is still considered a hobby of individual faculty members, a great deal of very exciting and valuable scholarship might go unrewarded and unrecognized by universities (Danielson, 1985).

John P. Crecine (1986), senior vice-president for academic affairs at Carnegie Mellon, says that the next level of computing on campus will be extremely powerful microcomputers, easily networked to each other and to large mainframes. According to Crecine (1986, p. 4), these "scholar's workstations" will build an "ultimate information-sharing environment" that would allow students and scholars to interact easily with each other and with other universities and learning centers. This model is already being explored at prestigious schools such as Brown University where an Annenberg/CPB project created a network of scholars' workstations. The goal of the network is to prototype software to be used in the arts, humanities, social sciences, and natural sciences.

Faculty Responsibility for Quality Assurance

Faculty are responsible for maintaining the quality of academic course offerings as set out by the policies of the institution, as well as the state, regional, and professional associations that accredit the activities of the institution. Tate and Kressel (1983) point out that, as long as courses are developed by faculty members for use on closed-circuit systems, course content remains in their control. However, when telecourses are brought to the institution, faculty lose control over content and find themselves in the role of reviewer or refiner rather than creator of course materials.

Faculty are concerned that the intellectual content of courses can be distorted and academic integrity damaged by non-academics who produce and edit the media formats. Faculty members serving as the instructor of

record in such offerings are only able to make modest adjustments to existing materials such as wrap-around materials developed locally. Peter Dirr (1983) reports that teachers express most of their frustration with course materials that do not meet their institutional, departmental, or personal academic standards.

It is not surprising that faculty are reluctant to accept canned material from other institutions, commercial vendors, and adjunct faculty members in their own departments. Any academic program that aims to include a large number of technology-based courses would have to confront this attitude.

Some Success Stories

According to Tate and Kressel (1983) and Schiller (1982), faculty members must have access to and control of the electronic delivery system and control of the content of courses that are transmitted electronically. The best examples of institutional policies are apparently those in which there is a minimum of special policies and procedures regarding telecommunications. These are the cases in which faculty are not downgraded for attempting to integrate new technologies into their teaching, writing, and research and in which credit is given in such a way that it counts towards tenure. The following cases are illustrative.

The Coastline Community College of the Coast Community College District in southern California has no campus of its own. It provides as many as 20 courses per semester to students who participate from their homes, workplaces, libraries, and a variety of other places. Courses are delivered through public and commercial television, cable television, public radio, video- and audiocassettes, telephone, and computer. Core liberal arts courses and related electives constitute the curriculum of this program (Lewis, 1983). Faculty who participate as telecourse managers receive additional compensation as an incentive. Furthermore, the funds returned through marketing of Coastline courses throughout the nation are placed in a general district-wide account for support of district colleges and the telecommunications operation. It should be noted, however, that in the early 1980s, a faculty action in other more traditional units of the college district created a backlash against the nontraditional part of the college from which it is only now beginning to recover. The complaint from faculty members at the traditional campus was that the telecourses were "academically substandard" (Cross and McCartan, 1984, p. 62).

The Chicago City College went through a similar experience. During a period in the 1960s, a substantial number of courses were made available to students via television in the greater Chicago area (Arms, 1985). A decade-long hiatus in this program has been remedied by the transfer of a television

station license from the local public broadcasting company to the college. At Chicago City College, courses are also offered via radio and videocassette, and faculty members are involved—on a released-time basis—in developing and producing courses. Faculty members are less involved in developing courses that are co-produced with other colleges, and not at all involved in developing courses acquired from national distributors. In all cases, however, faculty are centrally involved in the course selection process (Lewis, 1985).

Lewis (1983) also notes the case of Central Piedmont Community College in North Carolina. At Piedmont, there are as many as 150 courses that have audio and video modules. These modules vary in length from 10 to 30 minutes. Faculty members can choose to use these modules as part of the class or assign them for viewing or listening (via telephone) in campus learning centers or off-campus, learning support centers.

The critical feature of the Piedmont success story is faculty control of software selection. Generally, a telecommunications administrative unit selects pre-packaged software and then tries to "sell" it to reluctant faculty members. The decision to adopt telecourses, for example, is most often made by college administrators (Blackburn and Ging, 1986). By locating the financing of the project in the academic department, use of the technology is an issue addressed by full-time, tenured faculty members.

The Piedmont example highlights some of the conflict between the priorities of faculty and those of administrators. Administrators would rather work with group or consortial projects in order to purchase software at lower costs and reduce bureaucratic procedures. In fact, three-quarters of the institutions with large telecourse programs belong to some type of video consortia that instigate telecourse selection and adoption as a group (Dirr, 1986). Faculty see the issue as comparable to selecting textbooks for a class, a task that is historically an individual teacher's prerogative. Some of Piedmont's success can be attributed to the fact that the software selection process follows the tradition of faculty control of classroom materials.

A full schedule of credit and non-credit courses is offered on statewide audio conferencing networks by both the University of Wisconsin-Extension's Instructional Communications System (ICS) in Madison, Wisconsin, and the Rio Salado Community College of the Maricopa Community College System based in Phoenix, Arizona. Both programs are centered around a comprehensive and centralized administrative support center that arranges all technical and support activities for the program, including registration and recruitment, mailing out course materials, arranging for remote-site coordination, producing audio-visual course materials requested by the instructor, monitoring examinations, preparing student newsletters and, at

Rio Salado, organizing a student union where students "meet" on the telephone bridging system—the Sundial network—to study together or chat over coffee. The faculty are not expected to become technical experts, nor are they totally responsible for bridging the "interaction gap" of a long-distance learning program.

Equally important, both programs have structured extensive faculty training into the program. Faculty members are given training in effective use of the technology as well as hints on encouraging successful interaction with students. All course materials are prepared before the class is scheduled. Course packages are reviewed by curriculum experts who may suggest revisions or additions in the form of slides or other visuals. Although faculty control course content, they are given consulting assistance in adapting their course materials to the requirements of the audio conferencing format.

The University of Wisconsin-Extension's ICS is an example of significant state commitment to using information technology to meet the educational needs of the citizens of the state. The program which enrolls over 36,000 adults a year is funded through state appropriations and programming revenue (Cross and McCartan, 1984).

The National Association of State Universities and Land-Grant Colleges addressed the reform of faculty reward policies in relation to public service and proposed some of the following activities for state agencies (Elman and Smock, 1985):

- Act as a coordinator for interuniversity committees and exchanges on the topic of the role of faculty in the use of learning technologies. Institutions take their cues from other institutions, and the involvement of a number of universities and colleges in the same state will facilitate agreement on effective reward mechanisms.
- Sponsor regional conferences and workshops that offer examples and practice plans of licensure policies, faculty compensation policies, and models of documenting and evaluating products and scholarship. In particular, articulate the methods used in traditional reward systems for scholarship and teaching, and then look at possible adaptations for the use of information technologies.
- Encourage and help professional organizations to address the issue of faculty reward structures that go beyond scholarship.
- Sponsor training events that focus on the use of information technologies. Propose that training be included in budget requests for hardware purchases.

In conclusion, campus, system, and state higher education administrators clearly have a central role and responsibility for finding ways to

encourage greater faculty utilization of instructional technologies. In so doing they must ensure faculty involvement right from the start and build a support structure of policies and programs that recognize and reinforce the traditional faculty role as the key to instructional quality assurance. □

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OWNERSHIP OF INTELLECTUAL PROPERTY AND IMPLICATIONS FOR STATE POLICY

7

Richard D. Marks

MOST TECHNOLOGICAL innovations and new literary works in the United States are not in the public domain. They are privately held by owners who expect an economic return. As a result, state policies encouraging use of new technology in higher education must take account of the legal framework for rewarding owners of technological and literary innovation. This framework requires that states and state institutions of higher education approach courseware development as a business, as well as an educational enterprise. With planning, these two enterprises can be mutually reinforcing. Concentrating on contractual and financial issues early in the game increases chances of success in the long term. This chapter explains how the costs of developing, distributing, and purchasing computer-based instructional materials can be lowered significantly by attention to the legal intricacies of production and licensing agreements.

This chapter focuses on the literary property questions surrounding software, principally ownership issues regarding the literary content of higher education courses that are delivered by technological means. Most of these courses (including those with television components) will soon be stored in digital form, so computer-based instruction will form the bulk of the next generation of courseware. What do copyright laws say about software?

Some Definitions

Our task is difficult from the start because there is no all-encompassing "standard" legal definition of software. In some cases, what is distinct about software is apparent. In other cases, for example, firmware and microcode, important definitional elements are blurred. These distinctions may not be important in operating computer systems, but the lack of agreement on basic definitions bedevils lawyers, judges, and policymakers who seek ground rules for the use of computer-based materials. For our purposes, the term "software" includes computer programs and their documentation, as well as the subject matter of courses, or "courseware."

The rules affecting ownership and use of software come from federal and state law. Their interrelationship is complicated and not entirely satisfying. Federal law includes copyright and patent protection, and state law supplies protection for contracts and trade secrets. The law of trade secrets can be used to protect proprietary information, including data stored in computers and computer processes and methods. Copyright and patent protection, on one hand, and trade secret law, on the other, are not necessarily mutually exclusive. However, resort to patent or copyright protection can in some cases make it impossible to protect trade secrets. This chapter will not analyze trade secret protection further, because its use is unsuitable to most applications in higher education.

While computer programs can be patented,[1] patent protection is usually appropriate only when the computer program is part of a "new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof. . . ."[2] An innovation must pass tests of utility, novelty, and non-obviousness before a patent will be issued.[3] The problem is that most courseware does not fit in these categories. Rather, courseware is more likely to fit within the subject matter of copyright.

Basics of Copyright

Copyright, like patent protection, has its source in the United States Constitution. Article I, section 8, clause 8 of the U.S. Constitution empowers Congress, "To promote the Progress of Science and the useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries. . . ."[4] The constitutional basis of copyright is important because copyright restrictions are in tension with the protection of free expression in the First Amendment. The Supreme Court has explained that copyright promotes free expression by protecting authors' rights to the economic return on their works, thus encouraging literary and artistic efforts.[5] Nevertheless, that protection, in the form of restrictions on use of copyrighted materials, is an obstacle to teachers and students who seek free or low-cost course materials.

Reference notes appear at the end of this chapter.

Copyright can be used to protect a vast range of software, including computer operating systems and application programs, material that can be perceived only by using audio and video technology (video and audio programs, whether broadcast or distributed some other way), and associated text and pictorial materials (whether printed or stored electronically or by some other means). Copyright can cover the instructional materials themselves, as well as research and administrative information. It should be noted, however, that copyright protects *only original expression*; it does not protect the ideas or concepts expressed.[6] Unfortunately, consistently applying the distinction between ideas and expression is devilishly difficult, especially with software.

Copyright protection for material written today is derived from the Copyright Act of 1976, as amended, which went into effect on January 1, 1978. The act provides:

> Copyright protection subsists . . . in original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.[7]

Works of authorship include literary, musical, dramatic, pictorial, graphic and sculptural works, motion pictures, sound recordings, and other audiovisual works.[8] They include compilations,[9] as well as derivative works, that is, works based on a pre-existing work.[10] As we shall see, derivative works play a prominent role in policies directed toward the integration of technology in higher education.

Copyright is actually a "bundle of rights" that can be sold or licensed, together or separately. Licensing arrangements can be complicated, and must be carefully drawn. For example, the owner of the copyright of a book may sell the movie rights, the translation rights, or the sequel rights (each of which is a right to create a kind of derivative work). If the holder of a copyright of a book were to sell the motion picture rights to one party and the educational courseware rights to another, confusion would immediately arise because the use of a book in a course delivered via television is often accomplished by making a movie version of all or part of the book.

A license can be exclusive or non-exclusive. If non-exclusive, more than one person or entity can be given or sold the rights to exploit the same work in the same fashion. Licenses can be issued for a specific or perpetual duration (although copyright protection itself lasts only for the life of the author plus 50 years or, in the case of a "work made for hire," 75 years). After copyright expires, a license becomes valueless.

Copyright allows the owner five very important exclusive rights. These are the rights to reproduce the work; prepare derivatives; distribute copies

by sale, rental or loan; perform the work publicly; and display the work publicly.[11] These rights give the copyright owner virtually total dominion over the work. For example, a copyright owner can choose to lock a work away and entirely prevent its use during the copyright term.

These provisions are mitigated to a small extent by statutory exceptions, the most prominent of which is the right of "fair use." Fair use is meant to allow a narrow range of functions, such as criticism, news reporting, teaching, and research. Its application is determined through a four-part, judicially applied test that considers the purpose of the use, the nature of the copyrighted work, the amount and substantiality of the use, and its effect upon the work's market value.[12] Fair use is not considered an infringement. However, it is an uncertain and highly limited exception to the general rule that an unauthorized use of a copyrighted work is an infringement punishable by substantial fines and, in some cases, imprisonment.[13]

Software's Peculiar Copyright Problems

Copyright evolved in response to the development of the printing press, and, for hundreds of years, its evolution was shaped by the nature of printed products. Books and other printed materials are tangible; they can be held, counted and confiscated. They cannot be reproduced easily or immediately, nor stored invisibly. Their text can be changed only by printing new versions. Once in hand, their content is directly perceivable.

All these points, while obvious, often seem forgotten when people begin to examine the copyrightability of computer software. Software has an elusive nature that confounds lawyers and judges. It is intangible and cannot be directly perceived; but it can be reproduced almost instantly at a vast number of remote locations, as well as stored in a form that can be readily changed and which is difficult to count or confiscate.

In 1980, four years after its passage, the Copyright Act was amended to define "computer program" as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result"[14] and, to specify that copyright was not infringed by the owner of a copy of a computer program who made an additional copy "as an essential step in utilization" of the program in a machine, or who made the copy for archival purposes.[15]

Nevertheless, confusion persists as to whether computer programs are proper subjects of copyright. The conceptual problem is that copyright extends to original expression only. It does not apply "to an idea, procedure, process, system, method of operation, concept, principle or discovery, regardless of the form in which it is described . . . or embodied."[16] Certain computer programs are, in effect, the embodiment of machine processes

and other logical procedures. Even a program that records the text of a book can, when mixed with other programs in a computer, take on some of the characteristics of subject matter beyond the realm of copyright. A recent compendium of the subject described the problem as "the indiscriminate application of the doctrine of ideas and expression to three fundamentally different categories of works: works of art, works of fact, and works of function."[17]

The question of software's copyrightability was litigated in a number of cases in the early 1980s, culminating in a decision by the United States Court of Appeals which established that most computer programs could be protected using copyright.[18] The question now, however, pertains to the type and extent of protection that copyright will provide. For example, courts are wrestling with the problem of how much protection to extend to computer programs beyond protecting the exact code itself. Where does expression end and the idea begin? One federal district court, relying on the notion that everything not necessary to core purpose or function is "expression," recently concluded that copyright protects the structure of a computer program as well as its "literal code."[19]

Similarly difficult questions plague derivative works created by the computer.[20] For example, certain programs are designed specifically to interact with data stored in or manipulated by other programs. The result, in a sense, is a second- or third-order derivative. Its authorship is difficult to trace without specific guidance about the impact, in a copyright sense, of the work of the authors who prepared the programs to use as tools to generate the derivative in question. This is a matter of defining the reach of authorship in the tool programs.

A straightforward approach is to limit rights of authorship (the copyright rights listed above) in the tool programs to those programs only. A person who uses tool programs to produce a new work is then the new work's only author for copyright purposes. But this approach is too narrow to produce equitable results—or results that satisfy Congress' intent in the Copyright Act—in situations where, for example, particular programs are designed from the start to be building blocks in the construction of an ultimate work.[21]

Authorship of Computer-Based Courseware

Courseware designed to be delivered using the latest technological means is likely to have (1) a video component stored on tape or optical disc, (2) a portion stored in a computer, possibly to be used on an interactive basis, and (3) associated print material; it may also have (4) audio tapes and (5) discs. The subject matter of the course might be developed or assembled by one person, but it will more likely be the work of a team

of scholars, assisted by a team of production specialists. It is likely to include original material from the scholars working on the project and copyrighted material from other sources, including books, pictorial, graphic or sculptural works, speeches or performances. In addition, there may be material from the public domain (never before copyrighted or no longer subject to copyright protection).

These issues raise the following questions:

- Who owns the copyright in a project in which academic consultants are hired by a commercial courseware producer? Who gets the royalties? Does the answer differ if the producer is the university where the scholars are on the faculty?
- Who controls course content, the scholars or the producer? Who decides when the course needs to be revised or, if not revised, withdrawn from use? Is it possible to withdraw old versions of a course when other institutions have long ago purchased the course for their own use? How does courseware differ in this respect from textbooks?
- Who has the responsibility to create ancillary materials for telecourses (including computer-based courses)? Who has the right to create such materials? Does copyright limit the right of others to prepare their own course supplements?
- Who decides where, when and how often telecourses are to be offered? What control do universities and their faculties have over these decisions?

With the exception of the last query involving curriculum control, all these questions should be answered in properly drawn contracts that take into account the requirements of copyright law. This illustrates the fundamental contract-copyright framework in which courseware development and distribution takes place, and it underscores the necessity for states and their institutions to have early access to lawyers with experience in law pertaining to intellectual property.

To avoid infringement, the team must obtain permission to use each previously copyrighted item. This requires identifying and locating the copyright owner, obtaining permission in writing and, in some cases, paying a fee. Permission must be obtained to use the course material in all of the functional and geographic markets in which the producers plan to make the courseware available. In other words, in order to use each item, the team must purchase from the "copyright bundle" those rights that will be essential to the distribution of the courseware. This process can be arduous, expensive and exceptionally tedious. The time and cost of "clearing" these rights will often tempt the users to resort to fair use, so that the clearance process can be accelerated or avoided. In most cases,

however, relying on fair use will make the persons responsible for the course vulnerable to legal action for infringement.[22]

Assuming these rights are properly obtained, the question remains: Who is the author of the course or particular components of the course? Many colleges and universities, including state institutions, have policies specifically designed to answer this question and, in many cases, the policies permit sharing of rights between the institution and faculty members, sometimes depending on whether the material is developed during working hours or using institutional facilities. In such cases, a further question arises as to whether a particular policy fits the Copyright Act. Policies (or portions of policies) that conflict with the federal scheme can be voided in a court dispute over ownership.

Who is the author of particular courseware? A key to the answer is the Copyright Act's definition of a "work made for hire":

> (1)A work prepared by an employee within the scope of his or her employment; or
>
> (2)A work specially ordered or commissioned for use as a contribution to a collective work, as part of a motion picture or other audiovisual work, as a translation, as a supplementary work, as a compilation, as an instructional text, as a test, as answer material for a test, or as an atlas, if the parties expressly agree in a written instrument signed by them that the work shall be considered a work made for hire. (The Act further defines terms such as "supplementary work" and "instructional text.")[23]

This definition governs all work-for-hire relationships in the United States, and it can be a subtle source of not-so-subtle anguish. For example, certain universities have policies providing that faculty member will own certain works produced during working hours that result from scholarly activities that are defined as part of the scholar's job. Most such policies are not signed by faculty members. In a court dispute over ownership of particularly valuable courseware, a faculty member might find that he or she is unprotected by the policy. This is because, without signatures, the policy is ineffective as a matter of law, because it does not comply with the literal requirements of the work-for-hire provision. Therefore, the policy fails to vary the statutory work-for-hire relationship, even if state contract law might otherwise give the faculty member a contract-based claim of ownership. (To that extent, the state law of contracts is preempted by the federal requirement.) The faculty member loses any legal right to share proceeds.

Conversely, a university might find itself without ownership rights to courseware that it commissioned, particularly if contributions were sufficiently extensive so that faculty members could argue that their efforts were, at least in part, beyond the scope of their regular employment. The

problems in these examples might be solved by arguing that, by implication, appropriate licenses were created authorizing the faculty members and the university to use the courseware as apparently intended. However, such equitable arguments might be accepted only in cases of gross unfairness, if at all.

Additional problems follow courseware that is computer-based and thus subject to easy revision. Depending on how revisions are made, who makes them and who is authorized to do so, there is great potential for confusion about ownership rights in revisions. This confusion is not inevitable. It can be surmounted by carefully structuring the contracts covering authorship of the original course materials.

Legal Problems in Distribution of Computer-Based Courseware

Technological innovations over the past quarter century have led to a significantly different approach to literary property than in the past. Today, people have far less respect for ownership rights, and they are impatient with restrictions on use. This trend is illustrated by the rise in photocopying and the proliferation of copying machines in business and academe. Books, monographs, magazines and other publications are now copied routinely. Indeed, the issue of library photocopying was probably the most explosive dispute in legislative debates leading to the Copyright Act of 1976. That issue has now been surpassed by the myriad questions surrounding protection of computer-based information.

The intangibility of data in computers appears to produce a profound disregard for literary property rights. People think they *ought* to be able to copy software and use it on any machine. They have little compunction when altering software and, in some cases, distributing altered versions. They might even try to make money at it. Commercial producers and distributors of software have devised methods limiting these practices (which they regard as piracy), but not with astounding success. Shrink-wrap licenses and aggressive policing of corporate-level purchasers of software have decreased illegal copying and distribution, but abuse is rampant nonetheless.

These practices pose problems for institutions of higher education, both as distributors and users of computer-based courseware. From a user's perspective, enforcing restrictions against copying course materials is imperative. Otherwise, the college or university can find itself liable to copyright proprietors for infringement or contributory infringement. But adoption of strict policies and aggressive enforcement are doomed to partial success at best, because copying and alteration of computer-based materials can so often be done easily, quickly and in private.

An alternative strategy is to use courseware that is designed to be copied and, in some cases, altered. From the perspective of users, this sort

of courseware may be particularly well suited to higher education. Certain components of courseware are, of course, less likely to be copied than others. Currently, copying read-only memory is technically easier than copying a videodisc designed for interactive use. A crucial legal difference is the ability to avoid the burden of policing copyright restrictions against copying and redistributing materials. A university which distributes such materials over an interactive network, for example, will find relief from such burdens a tremendous advantage, saving money and increasing flexibility of use.

Universities can also benefit from software producers' site licenses and discount licenses for large-volume users, such as major corporations. These devices are a response to marketplace realities. Big users are becoming tired of policing against infringement, and are frustrated at the high cost of buying software licenses for each work station and the lack of flexibility that results. They are, with some success, pressuring software manufacturers into volume discounts and licenses that cover most or all of a company's computer stations. Such arrangements are ideally suited to the academic and administrative needs of higher education because, for the most part, they finesse the problems of copying and policing. University and governmental officials should support efforts to make site licenses a commonplace form of distribution. Even from a producer's perspective, a site license is preferable in many cases (assuming a fair price can be negotiated), because it obviates the expense of enforcing sanctions against copying.

The policy implications of providing courseware that can be used flexibly, that is, with little attention to enforcing copyright restrictions, is a major challenge to institutions of higher education and to state policymakers. It is also a natural path. Computer-based courseware lends itself to collaboration among scholars and people skilled in production of computer, audio and video course components. Most courseware, in other words, is not likely to be the work of a single author or a small group of authors, as is commonly the case with textbooks and workbooks. Moreover, courseware of this kind requires more resources than one author or small group of authors is likely to have; it requires institutional support. Consequently, there are philosophical and business justifications for adopting policies that require participants in the production of computer-based courseware to agree, from the outset, that the final product is an institutional one. Such a product should be distributed both within the authoring institution and outside it in ways that maximize its use, rather than the monetary return to the production team.

Courseware can be licensed to colleges and universities in much the same way that "site licenses" are used in the distribution of software to

large businesses. Under such a scheme, a college or university has virtually unlimited rights to use audio, video and computer-based textual and graphic components. If such courses also use books or workbooks, they would be distributed as they are now. Some copying would occur, of course, and its impact would be the same as at present.

In a courseware distribution system that places minimal emphasis on enforcing copyright restrictions, participating faculty cannot routinely expect to reap great economic rewards. Occasionally, however, a course might be so successful in national distribution that the participating scholars would enjoy significant economic returns as a result of university sharing policies. This differs little from publishing textbooks, where relatively few faculty earn significant royalties. Consequently, college and university policies are likely to emphasize scholarly credit for participating in development of computer-based courseware. Recognition is likely to come slowly, simply because the evolutionary processes at institutions of higher learning are slow. Quality control will be a major problem, and assessment of the comparability to more traditional forms of scholarship will be another. Nevertheless, consideration of work in telecourses and computer-based instruction will inevitably become routine in tenure evaluations and other assessments of scholarly achievement.

From a legal perspective, implementing these policies will require careful attention to developments in copyright law in order to preserve the work-for-hire relationships. The integration of revenue sharing arrangements in work-for-hire situations, satisfying the formalities of copyright law and the dictates of institutional policies, will soon be familiar legal tasks. State and institutional policies should be drafted to make such structuring as uncomplicated as possible, so that it can be carried out inexpensively on a routine basis. Predictability is important to faculty and institutions participating in courseware production.

Concomitantly, institutions of higher education should be prepared to enter into mutual distribution arrangements which decrease the costs of using computer-based courseware. Presumably, mutual distribution networks will allow producing institutions to recover their costs, plus additional amounts to support development of new courses. Some of these costs will be passed directly and indirectly to students, with the remainder paid by the same institutional sources that subsidize other academic activities.

Even in a system structured to minimize the need for copyright enforcement, copyright still has an important role to play in the area of derivatives. An institution can be the "author" of courseware in the copyright sense, but a scholar whose work is the core of each course has a strong, worthy interest in controlling the creation of derivative materials. This interest is no different from that of textbook authors who traditionally have

the right to publish updated editions of their works, take on collaborators of their own choosing and establish relationships with particular publishers. In other words, the intangible nature of information stored in computers does not alter the basic approach to scholarship or to the protection of rights in scholarly endeavors. Institutional courseware producers are therefore likely to insist on contract terms that restrict alteration of authorized editions of their materials. This interest will create another gray area, as schools seek to further course use while maintaining the integrity of core materials.

Institutional Structuring and the Role of Counsel

Universities that produce computer-based courseware, particularly courseware with video and interactive video components, will need to assemble and sustain (or rent) expensive production facilities. This will encourage producing universities to distribute courseware under license for an appropriate economic return, whether or not in mutual distribution arrangements. At present, we are only beginning to face the legal implications of these economic patterns.

Universities must assess whether extensive courseware production and distribution fit comfortably in the institutional mission. From a practical standpoint, the institution must find a way to integrate course production with the mainstream of scholarship. Quality control and the need for faculty acceptance of electronic delivery systems will demand it.

Some universities will develop production facilities that draw upon scholars from other institutions, and these universities might begin to resemble production centers whose courseware output is distinguishable—maybe readily so—from other, more traditional academic activities. Such an evolution will raise legal questions. Each university will have to ask whether, under the tax code, its courseware production is sufficiently related to its basic academic purpose so as to qualify for tax-exempt treatment. Because the analysis will vary widely among institutions, the structuring of production and distribution arrangements at any particular university will necessitate careful business and legal analysis. Questions can be expected, for example, about the desirability of forming for-profit subsidiaries or affiliates to undertake course production, distribution or both.

Federal law imposes the basic framework for consideration of ownership rights in intellectual property, including courseware distributed by computer and computer-related technology. We cannot now foresee the intricate mix of production and distribution arrangements that will evolve. However, the cost of developing, distributing and purchasing computer-based instructional materials can be lowered significantly by careful attention to the legal intricacies of production and licensing agreements. □

References

[1]*See Diamond v. Diehr*, 450 U.S. 175 (1981).

[2]35 U.S.C. §101 (1976).

[3]35 U.S.C. §101, 102, 103 (1976).

[4]U.S. Constitution art. I, §8, cl. 8.

[5]*Harper & Row, Inc. v. Nation Enterprises*, 105 S. Ct. 2218 (1985).

[6]*See* 17 U.S.C. §102 (a), (b) (1976).

[7]17 U.S.C. §102 (1976).

[8]17 U.S.C. §102 (1976).

[9]17 U.S.C. §103 (1976).

[10]*Id.*

[11]17 U.S.C. §106 (1976).

[12]17 U.S.C. §107 (1976).

[13]17 U.S.C. §§501-510 (1976).

[14]17 U.S.C. §101 (1980).

[15]17 U.S.C. §117 (1980).

[16]17 U.S.C. §102(b) (1976).

[17]U.S. Congress, Office of Technology Assessment, *Intellectual Property Rights in an Age of Electronics and Information* (1986), at 65.

[18]*Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984).

[19]*Whelan Associates, Inc. v. Jaslow Dental Laboratory*, 609 FSupp. 1307 (E.D. Pa. 1985)

[20]*Intellectual Property Rights in an Age of Electronics and Information, supra* n.17, at 79.

[21]*Id.* at 81-83.

[22]*See Educational Testing Services v. Katzman*, 793 F.2d 533 (3d Cir. 1986) (fair use no defense in action seeking injunction on infringement grounds against company that allegedly copied "secure" test questions for purpose of preparing students to take ETS tests).

[23]17 U.S.C. §101 (1976).

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STRATEGIES FOR FAMILIARIZING POLICYMAKERS AND EDUCATORS WITH INFORMATION TECHNOLOGIES

8

Ralph D. Mills

THE TASK of rethinking higher education to fit the context of the information age poses an enormous challenge to those most responsible for ensuring a proper fit between institutions of higher learning and the needs of society. In the national tradition, those entrusted with this stewardship are policymakers and educators. These include governors, legislators, state board executives, commissioners of higher education, trustees, institutional administrators, and faculty members. All must participate. Each has a critical role to play.

Before the various actors can play their roles adequately, however, they must become aware of the new technologies. Additionally, they must realize that the technological revolution has raised a fresh set of legitimate—but complex—academic, financial, personnel, and public policy issues which promise to have a serious impact on existing policy structures. As Steven Muller (1983, p. 32) points out, the problems now confronting higher education are "fundamental and radical." Only informed individuals acting in an appropriate public policy environment can rethink higher education in ways that best serve the public interest.

The times call for closer cooperation between the states and institutions of higher education. Such cooperation should be undertaken to establish a more flexible, supportive environment within which institutional leaders and faculty members can develop information technologies in a manner which will ensure that higher education and the public reap the benefits of the technological revolution. This chapter outlines the reasons why

policymakers at the state level should oversee the integration of learning technologies into higher education. This chapter also suggests that, in order to carry out the successful integration of learning technologies into higher education so that the quality of education and people's access to it is enhanced, policymakers and educators must become familiar with the capabilities and limitations of the new technologies. Several specific strategies are therefore suggested to familiarize policymakers and institutional leaders with all aspects of the new technologies.

The Policymaker's Perspective

For several reasons, it is vitally important that state policymakers assume oversight responsibility for the progress of the technological revolution in higher education. The first reason is that powerful forces are driving institutions toward the integration of technology into the academic environment for purposes of public service, research, and instruction. Increasingly, employers and parents expect graduates to be prepared to function as individuals, employees, and citizens in the emerging information society.

Another force motivating institutions to acquire and use technology relates to competition. A technology-rich curriculum will help to ensure a continuing supply of student applications. Additionally, technologies that enable an institution to serve distant learners open up new student markets, not only in the local area, but also throughout the state, the nation, and the world. Appropriate technology can also enable an institution to carry out research projects, either alone or in cooperation with business and industry or other institutions of higher education. Reactions of people to these forces can raise significant questions about institutional mission and purpose. When its vested interests and survival are at risk, a college or university cannot always be counted upon to act in ways that are entirely consistent with public interest.

A second reason policymakers at the state level must be attentive to information technologies is that many of the issues being dealt with by institutions seeking to acquire and utilize these technologies have an integral relationship with state fiscal policies and practices. This involves the cost of purchasing, operating, and maintaining hardware; the cost of developing, renting, and purchasing software and courseware materials; the cost of providing faculty incentives to become involved, including training and professional development programs; the cost of measuring performance and productivity; and, finally, the cost of additional technical and professional support staff required to service and sustain the technology-oriented curriculum and delivery system.

A third reason that policymakers must assume oversight responsibilities is that issues of equity and access are raised when self-selecting institutions create—through individual initiatives—a technology-rich curriculum and the ability to outreach electronically. This situation can create real or perceived imbalance in the quality of instruction and the capacity of the institution to attract and retain faculty and students. Both local and distant learners have greater access to the academic programs and support services of institutions with electronic delivery capabilities. When such programs are self-supporting, they may be accessible only to the employees of specific firms or to individuals who can afford them.

A fourth reason for vigilance on the part of policymakers is that the introduction of technology into the instructional process raises questions about academic quality and consumer protection, matters of traditional concern to the states.

A fifth reason is that the new and emerging technologies, although costly, lend themselves in many instances to shared use and cooperative endeavors. Examples of such technologies include supercomputers, instructional television fixed service (ITFS), satellites, microwave and telephone networks, as well as production facilities for software and courseware. There is also great cost-savings potential in the shared creation, purchase and use of software, courseware, and instructional programming at the local, state, and regional levels. Institutions have already demonstrated a capacity to associate themselves voluntarily to achieve special benefits. Greater and more beneficial results can be achieved through judicious state initiatives.

A final reason is that information technologies will continue to develop and provide higher education the opportunity for innovative applications. Clearly, the possibilities are not limited to instructional considerations. They also include student and instructional support services, research, public service, and every aspect of academia. Ultimately, they can contribute to scholarly productivity and create a higher quality working environment for students, faculty, and administrators.

Information, Orientation, and Training Needs

Whether institutions take advantage of the opportunities created by the technological revolution will depend to a large extent upon funding and policy decisions made by elected officials with respect to the acquisition and use of information technologies. These decisions, in turn, will be greatly influenced by the advice governors and legislators receive from state higher education agencies, state budget officers, and educators. It is therefore important that all those involved in the decisionmaking process be sufficiently acquainted with the information technologies to perform their

respective roles effectively. State policymakers need to be aware of the ever-widening gap between the capabilities of information technologies and the funding and policies needed to foster the use of these technologies. Similarly, if state higher education executive agency personnel are to perform their advisory, coordinating, planning, and review functions effectively, they must be aware of the issues raised by the integration of information technologies into the higher education environment.

State higher education executive agency personnel and institutional administrators will need to have an understanding of the practical aspects of planning and budgeting in the emerging technological environment. They must have good information about: hardware and software costs, capabilities and limitations of the different technologies, impact on existing policies and funding practices that relate to faculty workload and workload measurement, cost-benefit relationships between present methods of instruction and new methods involving the technologies, and possibilities for improved productivity and access. They must also be aware of how different technologies can be best utilized for interinstitutional, intersegmental, and interstate collaboration and cooperation in areas such as programming, training, and development, as well as shared use of equipment, networks, courseware, and software.

Faculty members must acquire special skills to use the new audio, video, and computer technologies, as well as learn how to develop courseware and software. They must learn techniques for effective teaching before cameras, while interacting with distant learners via telephone. They must develop special skills needed to adjust course content and their own teaching style to fit the information medium. They must also learn how to prepare and present course material in conjunction with a team of professional and technical personnel.

Faculty and administrators need to learn more about the impact of the new technologies on workload and performance requirements. They need a better understanding of the potential of technology to improve the quality of a faculty member's teaching, research, and service. Indeed, all those who participate in the decisionmaking process must be persuaded that the use of information technology will improve the educational process and enhance higher education's role in society. Until they are so persuaded, they cannot be expected to create and sustain an environment that nurtures the use of the new technologies.

Strategies for Initiatives in Technology Literacy

Many strategies can be used to enhance technological literacy among state policymakers and their advisors, as well as institutional leaders and faculty members. Not all strategies apply equally to every situation. The

information, orientation, and training needs of policymakers, state board personnel, and educators will differ from one state to another, one institution to another, and one individual to another. Specific needs will most often differ in degree rather than in kind. Perhaps the most pronounced differences are between the needs of faculty members and the needs of others. It should be kept in mind that the value of the strategies suggested below depends upon several factors, including their relevance to existing needs, timing, the current environment, and the manner in which each is implemented.

Start at the Top. Many opportunities exist for presidents and other executive officers to share information about problems, techniques, and achievements. Special efforts should be made to place issues relating to information technologies on meeting agendas for national, regional, state, and system meetings. Opportunities should be sought out to exchange views on policies, procedures, and planning as these relate to the introduction of technology into the curriculum.

Generally, the best and most credible source of information available to administrative officers at all levels is the peer group. On the basis of extensive interviews with presidents, provosts, and chief academic officers, David G. Brown (1979, p. 71) concluded that "although presentations by experts . . . have great value, professional vitality is best maintained through sharing of information within the professional group."

Scan the Information Technology Environment. State boards and institutions must monitor trends in information technologies and consider what their impact will be on existing state and institutional goals, program planning, access, program delivery, physical facility requirements, equity, quality of instruction, and the measurement of faculty workload. This information should be integrated into every level of state and institutional planning.

Visit Exemplary Projects. When visits to exemplary programs are carefully coordinated and projects visited are selected to satisfy the specific interests of the visitors, then policymakers, state board staff members, and educators can learn a lot. First-hand observations will provide a keen appreciation for program operations. Faculty and administrators responsible for the projects being visited can provide valuable information about project-related problems and opportunities, faculty training requirements, and costs associated with acquisition, maintenance and operation of program hardware and software. The visit also provides an opportunity to begin or expand a network of people familiar with the issues associated with the use of information technologies in the academic setting.

Lewis (1983) conveniently provides a documented inventory of programs, projects, consortia, and associations devoted to serving the off-

campus student. Other projects are widely publicized in the literature on a regular basis, and many new projects are being implemented by institutions and states across the nation.

Form a Task Force. During 1984-85, approximately two-thirds of the nation's institutions of higher education had a task force, a study group, or an administrative officer engaged in an assessment of the educational applications of video, voice, and data equipment and facilities for instructional purposes (Riccobono, 1986). Many state task forces and study groups have also been established to study the problems and opportunities associated with the new technologies. Creating such a task force is an important statement. It focuses attention on the subject, while demonstrating that state and institutional leaders are aware that information technologies must be taken into account when planning the future of higher education.

Whether created at the regional, state, or institutional level, if the task force is to have credibility, it must be representative of the "stake holders." At the state level, for example, membership should include appropriate representatives of the executive and legislative branches of government, institutional and segment leaders, trustees, faculty leaders, and the state higher education executive agency. Faculty participation is also vitally important because it is the faculty members who must implement change in the curriculum and instructional process.

The basic purpose of the task force is to encourage the adoption of regional, state, or institutional policies and procedures designed to facilitate the integration of information technologies into the functions of higher education. To accomplish this purpose, the group should design and implement a series of innovative initiatives at the regional, state, or institutional level. To be aimed at policymakers, state board staff, trustees, institutional administrators, and faculty members, these initiatives should be designed to achieve specific objectives relating to the acquisition and effective utilization of information technologies in support of the state's or the institution's educational goals. The following are some suggested objectives:

- Develop and maintain an "information technology profile" of the region, state, or institution. The profile should include an inventory of existing and planned facilities, hardware, software, electronic networks, and personnel, as well as current applications, obstacles, and opportunities.
- Enhance awareness of the new information technologies and their educational potential.
- Gather and disseminate information about hardware, courseware, and software with reference to availability, application, capabilities, and limitations.

- Identify and learn to manage opportunities, barriers, and obstacles relating to the use of new and emerging technologies.
- Identify and focus appropriate attention upon the policy implications inherent in the use of new and emerging technologies.
- Design and implement appropriate information and resource-sharing, training, and development activities in response to identified needs.
- Explore and focus attention on opportunities for collaborative use of information technologies and cooperative program development and delivery at local, state, and regional levels.
- Gather and disseminate information concerning ways information technologies can enhance productivity in academic programs while improving the quality of work-life among teaching faculty.

The first step the task force must undertake is to gather information. This is a critical step. Sufficient time and resources should be allocated to this enterprise. To focus attention of constituents on the issues involved, activities of the task force should be given maximum exposure. To achieve this objective and ensure the broadest possible participation of constituent groups in information-gathering, the task force might establish a variety of subgroups and conduct well-publicized hearings. In the case of regional, state, or system task forces, special policy briefings and status reports might be presented via satellite-based video conferences to permit the broadest possible participation by state and institutional policymakers.

Import Expertise. State boards and institutions might hire a consulting firm, engage the services of a visiting team made up of experts from other institutions of higher education, or bring in individual consultants. Agencies, in cooperation with institutions, should establish or participate in faculty/staff exchange and internship programs that focus on individuals who have an understanding of the various technologies and their applications. Experts can provide a variety of technology-oriented seminars and workshops.

Though some consultants may not be as sensitive to the academic culture as exchange or visiting faculty and administrators, non-academic consultants can frequently bring greater objectivity and a fresher point of view to issues under consideration. This objectivity can be especially valuable at the state level where the interests of states and individual institutions do not always coincide.

Join Consortia. According to a recent national study (Riccobono, 1986), approximately one-third of the nation's colleges and universities belong to consortia that are oriented toward technology, with proportionately more public (40 percent) than private institutions participating. Institutions that have not already done so should consider joining regional

and national consortia. Or, they should join with other institutions to create local consortia to assist with problems relating to training and development, as well as those relating to the availability of quality computer and video software and courseware. Services generally available through consortia include group purchase of hardware, courseware, and software; sharing of software and courseware previews and evaluations; sharing of member-developed software and programs; computer and video networks and networking assistance; faculty and staff training and development; and technical planning assistance.

Establish Cooperative Networks. States and institutions should establish cooperative telecommunications networks for information-sharing, conferencing, and training purposes. Computer-based utilities (data bases, electronic mail, bulletin boards, and computer conferences) should be established to enable state boards, institutional administrators, and faculty to exchange information about hardware applications, capabilities, limitations, costs, problems, and opportunities. Additionally, these networks should be used to exchange evaluative information on software and courseware, as well as provide an on-line catalog of such materials.

Policymakers, state board personnel, and educators should establish forums on technological issues of common concern that include topics such as serving distant learners, accreditation standards and practices, financial policies, planning guidelines, model legislation, and new standards for measurement of faculty workloads.

Audio and video conferences should be utilized to conduct special briefings for policymakers; provide state boards, administrators, and faculty conferences featuring special applications of various technologies; disseminate the results of special studies and reports relating to the use of information technologies in higher education. Video conferences should also be utilized to conduct faculty and staff training programs on such matters as hardware operation, software, courseware, and various aspects of the design and development of material.

Regional and statewide networks could be coordinated by a designated institution, a special network staff, or a regional organization such as the Western Interstate Commission for Higher Education (WICHE). Alternatively, states and regions might benefit from an affiliation with existing information-technology networks such as the National University Teleconference Network (NUTN) or EDUCOM. In other instances, state and regional agencies might suggest that institutions with the needed technologies undertake jointly sponsored networks, thus enabling the "have-not" institutions to benefit from the resources already acquired by others.

Establish a Cooperative Information Technology Studies Center. States and institutions should establish independent or cooperative centers

for the study of technology. This type of center, which might be more of a concept than a place, could carry on a variety of activities relating to technology and education. It could conduct policy research and provide information and advice on issues of interest to policymakers and planners; assist institutions in the enhancement of the efficiency and effectiveness of existing technology applications; advise on how to improve teaching and learning effectiveness through the use of technology; and study how information technology can enhance the productivity of higher education, as well as the quality of professional life among faculty members. State boards and institutions should cooperate in bringing together legislators, executives, and institutional leaders to hear presentations on these topics. Additionally, the center might conduct conferences for policymakers and educators, providing them with a conceptual orientation and information about current technologies and their likely instructional applications. Topics might include computer-assisted instruction, videodisc technology, long-distance learning via technology, and anticipated innovations. To supplement such conferences, the center might demonstrate hardware and software and schedule additional demonstrations at appropriate demonstration sites. Such a center, along with its various activities, might be sponsored by a state, an institution (in cooperation with information technology industries), or by a regional organization.

Seek Expert Legal and Business Advice Early. Campuses entering into licenses with producers of computer and video software and courseware must now adopt policies and practices designed to protect themselves against infringements of user agreements and copyrights. Institutions considering cooperative hardware or software acquisitions, development, utilization, or production ventures with their own faculty, other institutions, or for-profit entities must take care to protect their legal interests while minimizing exposure to liabilities. Institutions considering serving distant learners via such technologies as ITFS systems, satellite, or terrestrial microwave must apply to the Federal Communications Commission (FCC) to obtain licenses to construct and operate telecommunications systems, and protect against signal interference.

The issues raised by these considerations are new to most institutions, and they must not be ignored. There are many legal firms familiar with the maze of FCC regulations and procedures that can provide invaluable services to institutions, saving them time and frustration. It is important that the services of these firms be obtained early in the process.

In addition to legal assistance, institutions considering business ventures should seek consulting firms that specialize in getting new business ventures developed and off the ground with minimum difficulty and risk. Such business ventures often require the development and execution of complex business plans that involve risk capital, market analysis, as well as planning,

distribution, and other matters unfamiliar to most colleges and universities. In these cases, outside help provides the breadth of knowledge and the objectivity needed to ensure the soundest possible decision.

Establish Leadership Seminars. A state or regional leadership institute for policymakers, executives, and faculty leaders should be established to encourage leadership in the use of information technologies for educational purposes. Fifteen to twenty participants should attend intensive sessions with experts in the use of educational technologies. Topics covered should include applications, financing, planning, faculty and staff development, hardware, software, and courseware. Special policy briefings and reports should be provided leaders via satellite-based video and audio conferences on an invitational basis. Such seminars should be conducted under the aegis of established state, regional, and national organizations.

Attend Conferences, Workshops, and Seminars. In recent years the number of national and regional conferences, seminars and workshops on information technologies has increased. Sponsored by national higher education associations such an American Association of Higher Education (AAHE) and American Council on Education (ACE), individual universities, and even by business concerns and associations, these conferences and seminars provide immediate, cost-effective orientation for those who participate in the state policymaking process, enabling them to obtain considerable information about information technologies and their actual and potential instructional applications. At the typical conference, there are practical workshops in which specific hardware and software applications are discussed and demonstrated.

Selective Implementation. For a variety of reasons, including limitations of funding, space, and human resources, technology often creeps into the instructional program along lines of minimum resistance. Disciplines such as computer science, business, and engineering have a greater affinity for the information technologies than do most other disciplines. As a first step toward introducing information technologies into the instructional program, it may be useful to strengthen the involvement of academic units with the least resistance and then seek their support in introducing the technologies to units with less natural affinity. Faculty often take the initiative in the area of professional development when they perceive the contribution technology can make to the teaching/learning process, or when they perceive the relationship between technology-rich instructional programs and the number of majors their discipline can attract.

If adequately supported in their efforts to integrate technology into instructional programs, such academic units can generate institutional resources for future orientation, training, and development efforts. Where funding is a major factor, this approach has the added advantage of spreading

the cost of integrating technologies into the curriculum over time, while allowing both faculty and the administration an opportunity to observe and evaluate the technology, training and development, and maintenance requirements.

Exploit Successful Projects. Institutions already utilizing information technologies in some academic units or programs should involve senior faculty members from these programs in the design and implementation of training and development programs for other faculty members. Such faculty can also serve as resident consultants to the institution, as well as to other academic units. Faculty from experienced departments and programs should be encouraged to demonstrate the use of video, voice, and computer technology for instructional purposes and discuss and demonstrate the application of new technologies for the benefit of other faculty and administrators. The use of resident faculty as advocates should, if necessary, be supplemented by the use of faculty from another institution that has successfully integrated one or more of the information technologies into its instructional program. Institutions should take advantage of the fact that faculty have greater credibility with their colleagues than do outside consultants or administrators.

Implement Technology Literacy Programs and Activities for Faculty. Faculty must be capable of making appropriate professional use of the emerging information-processing technologies, particularly in connection with the instructional program. Of course "appropriate use" will be defined by each individual, based on that individual's particular need and situation. It can range from being required to use courseware efficiently to being able to program or author courseware. However, the literacy effort needs to be broadened to include developments in audio and video technologies, as well as electronic networking. It is particularly important that educators understand that video, voice, and computer technologies are being integrated and networked in ways that have significant implications for the future of higher education, the role of faculty members in the academic setting, and the organization and structure of colleges and universities.

Plan Faculty Training and Development Programs. The following six points should be considered when planning a program to familiarize faculty with the new information technologies: (1) develop a good information base about professional development programs, the institution, and the individual faculty to be served; (2) build flexibility into the program so that the needs of the institution and individual faculty members are met; (3) involve faculty who will utilize the program in the planning of its operations; (4) plan an evaluation component that takes into account feedback from faculty clients; (5) undertake planning for faculty

development in conjunction with established academic planning processes to ensure that individual faculty member's objectives support the institutional mission; (6) establish the kind of credibility that comes only with a demonstrated and sustained institutional commitment (Pellino et al., 1981). □

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STATE LEADERSHIP: THE KEY TO SUCCESSFUL INTEGRATION OF NEW TECHNOLOGIES INTO HIGHER EDUCATION

9

Patrick M. Callan

VALUABLE LESSONS can be learned from the experiences of the few states where plans for the integration of technology have been developed. While the preceding chapters have identified the most important policy areas and attempted to provide useful insights and options to consider, it is clear that no single pattern exists for effective state planning and policy development in the rapidly evolving field of information and communications technology. What is clear, however, is that the new learning technologies offer tremendous opportunities, and the challenge is to effectively integrate them into higher education. State leadership is a key factor that will determine whether higher education will be able to meet this challenge.

State and educational leaders should begin with a concept of technology as a means and not an end. The challenge is to develop "the grand idea:" using technology to discover ways to encourage and stimulate learning (Van Horn, 1986). The impetus to state-level involvement ought not to derive from issues of rationalization or control, although efficiency will always be a major concern. Nor is the crucial issue one of regulation, although effective regulation in some areas is essential. Rather, the fundamental issue is how to use the new technologies to improve teaching, learning and educational opportunities. State leaders should ask themselves: Is the primary focus in the state with respect to telecommunications policy being placed on the issues that will make the greatest difference to the educational enterprise in the long term? Whether higher education is thought of in

terms of intellectual productivity, more active, individualized, self-directed student learning or lifelong learning, state leaders should initiate planning and policy efforts that use technology as a means to achieve excellence in education.

The impetus for planning and policy development has varied from state to state, as has the locus of leadership. While there might not be an easily exportable or replicable planning model, there are common issues and tensions that emerge. The type of state higher education structure or governance is clearly not the critical variable in effective telecommunications planning. A statewide governing board, for example, is not more likely to be successful in the planning and implementation of major telecommunications initiatives than a coordinating board. Moreover, the initial source of leadership that addresses the issue of technology is not a significant factor. In Indiana, for example, the initiative involved the participation of all entities of state government. In other states, including Nevada and Oklahoma, the higher education system played a leadership role, not only for the higher education system but also for all of state government. Regardless of whether the leadership initially comes from colleges and universities, the state higher education boards or other state agencies, it is essential to involve as early as possible all of the actors, including governors, state administrators, state budget officers, state legislators, college and university officials, as well as faculty members.

The magnitude of the investment that states are being asked to make in telecommunications technologies suggests the need for collaboration among state agencies, multi-campus systems and institutions of higher education. However, there are some dangers in this process. One of the risks is that the planning and policy development process will be driven by non-educational agencies, with the result that administrative considerations, rather than instructional considerations, will drive system development. Such efforts at the state level are typically led by departments of general services which often place little value on the participation of institutions, students and faculty members. When participation is limited, the predictable outcome is greater resistance to educational applications of technology. There is also the danger that the costs of technological systems will lead states to build in layers of organization that may slow down and complicate acquisition and installation plans. This can be a process of bureaucratic attrition that hinders the kind of experimentation, creativity and flexibility that is needed.

The locus of decisionmaking tends to move farther and farther away from the faculty member as more complex and expensive technologies and courseware are incorporated into higher education. Consequently, decisions, including decisions relating to course approval, are more likely to be made at levels where they have not traditionally been made. Such

a change in the locus of decisionmaking runs counter to the tradition of decentralized and semi-autonomous decisionmaking in higher education, and therefore poses a fundamental policy dilemma for policymakers. While highly centralized bureaucratic approaches can deprive the process of vitality and faculty confidence, completely decentralized decisions can result in excessive costs and poor quality. Policies are not likely to be effective which are developed without equal sensitivity to the dangers of excessive centralization, on one hand, and technological anarchy, on the other.

Well-structured, competitive grant programs—coupled with rigorous evaluation and careful attention to dissemination of the results of pilot programs and experiments—comprise a policy approach that encourages institutions and faculty members to experiment and innovate. A few provisos should be kept in mind, however. Because incentive programs are not integrated into the base funding system or into formulas, this strategy tends to keep technological applications on the periphery. Moreover, if grant programs are considered add-ons, they can be particularly vulnerable in times of fiscal retrenchment.

Financing issues, of course, come to the forefront in state and system planning. The expenditures for equipment and operations characteristic of many of the information technologies require rethinking of conventional approaches to financing higher education. The financing of technology also raises such questions as: How much should a student pay for access to information technologies? Should the student's share be part of regular tuition or a categorical add-on? These questions are significant, not just with respect to technology, but have broad implications for the financing of public higher education.

One of the most disquieting issues is that of regulation for quality control, an issue that is on the policy agenda of several states. Policymakers recognize that technology is a powerful tool, not only for institutions and faculty who wish to use it to enhance education, but also for those whose interest in quality education is secondary to increased enrollments and profits. State policies should seek a balance between regulation for public protection and the encouragement of innovative methods for delivering education.

There are several ways that state officials can take a leadership role to support integrating the new learning technologies into higher education. These include the following:

- Obtain information about needs and resources. State higher education officials should discern what resources are currently in place, which clienteles are currently being served and who should be served in the future. They can ask: What educational needs exist among special clienteles that could be met effectively via technology? Special clienteles

may include adults in rural areas, professionals seeking continuing education opportunities and teachers seeking continuing education.

- Initiate planning and coordinating efforts. The market-like character of higher education guarantees that the use of information technologies will increase, but the direction of the increase will be towards available resources, not necessarily toward unmet needs or state purposes. By itself, planning cannot guarantee the best uses of the technologies, but it can point to unmet educational needs, underserved clienteles and unrealized state goals.

  Coordination cannot guarantee creativity, but it can reduce unnecessary duplication of expensive facilities and programs. State officials should find out what cooperation is already taking place among the institutions in the state, especially those that are state funded, as well as the incentives for and perceived benefits of this cooperation. Leaders can look for opportunities for additional interinstitutional and interstate cooperation.

- Encourage collaboration through regulation and development of incentives. Attempts to stimulate collaboration should take into account the relative paucity of such collaboration in American higher education and the difficulty of achieving it. It should also be kept in mind that incentives to use the new technology must not only reach the institutional level, but also must involve and reach faculty, and overcome barriers of resistance, the entrepreneurial faculty work style, and the traditional reward system.

- Regional interstate cooperation is a promising approach. Here the question is: Can the states' multi-campus systems and institutions cooperate while they are struggling to rationalize their own systems? All have common problems, including high costs, limited resources and information gaps. It should be kept in mind that, although every state is unique, no state is quite as unique as it believes itself to be. The potential for collaboration is often greater than is initially assumed. Beyond the benefits of efficiency, cost savings and resource sharing, the value of regionalism is that it minimizes the provincialism to which all states are vulnerable.

State leaders, to summarize, can significantly influence the process of integrating telecommunications into higher education. They can create a policy environment in which colleges and universities are encouraged to use technology to improve educational opportunities. They can prevent the misuse of technology by those who might try to avoid state provisions for consumer protection or quality assurance. They can also encourage institutions of higher education to address educational effectiveness, and

encourage collaboration through regulation and development of incentives for faculty.

New technologies provide one avenue for stimulating and encouraging constructive change in higher education. The ultimate criteria against which efforts aimed at appropriate applications of technology in education will be assessed are the improvement of instruction and enhancement of the student experience. □

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APPENDIX A
Subchapter J: Televised Instruction. (Policy adopted by the Coordinating Board of the Texas College and University System)

5.191. **Scope and Purpose.**

(a) This subchapter is designed to encourage the development and use of television for educational purposes while ensuring a level of quality equivalent to that of regular on-campus resident credit instruction. The rules and regulations in this subchapter apply only to institutions over which the Coordinating Board has authority under state law.

(b) The Coordinating Board shall consider an institution's entry into delivery of televised instruction to be a change equivalent to a request for a new degree program, requiring the development of an Institutional Plan for Televised Instruction in accordance with Section 5.195.

(c) Courses offered through televised instruction shall be subject to the approval procedures of Subchapter H for off-campus and out-of-district courses in order to be eligible for state funding of semester credit/contact hours. These courses must be reported through the Coordinating Board's uniform reporting system under the code for "Televised Instruction" as defined in the Educational Data Service Reporting Manual.

(d) The Commissioner of Higher Education shall appoint an Advisory Committee on Telecommunications to advise him on the implementation of these rules and regulations and other matters related to present and future delivery of education via communication technologies.

5.192. **Definitions.**

(a) ***Televised Instruction***—Any form of instruction that uses live and/or pre-produced television programs as a primary mode for delivering instruction to the student at a location removed from the physical presence of the instructor. Delivery systems may include but are not limited to one or more of the following: open-channel television, closed-circuit television, cable television, low-power television, communication and/or direct

broadcast satellite, satellite master antenna system, microwave, video tape, video disc, and telephone line.

(b) ***Telecourse***—The subset of televised instruction that uses pre-produced television programs as the primary mode of instructional delivery.

5.193. **Exemptions.**

(a) The following courses shall be exempt from the rules and regulations contained herein:

(1) organized classes offered by television by an institution on its campus or among campuses within its system;
(2) noncredit extension, correspondence, or other continuing education courses; and
(3) credit courses which are self-supporting, paid for entirely by the students, or do not involve state funding.

(b) Other exemptions to all or part of the rules and regulations contained herein may be made by the Commissioner and the Coordinating Board on recommendation of the Advisory Committee on Telecommunications.

5.194. **Standards and Conditions.**

(a) Each course offered through televised instruction must be applicable to a campus-based degree or certificate program approved by the Coordinating Board for the institution.

(b) Courses to be offered through televised instruction must be included in the institution's current course inventory as approved by the Coordinating Board.

(c) Reception sites for televised instruction (other than reception in homes or on main campuses) must be recognized as auxiliary locations in advance by the Commission. Community/junior colleges also must obtain recognition of reception sites within their districts prior to offering televised instruction at those sites.

(d) If an institution proposes to offer televised instruction subject to Coordinating Board regulations in a community or district in which another institution of higher education is located, the proposing institution must notify the local institution according to procedures described in Subchapter H for off-campus and out-of-district courses.

(e) If an institution objects to delivery of televised instruction by another institution in what it regards as its geographic service area, and if an agreement between the two institutions cannot be reached, the Coordinating Board shall consider the matter in accordance with the procedures in Subchapter H for off-campus and out-of-district courses.

(f) Funding formulas for community colleges and for senior colleges and universities shall be used for funding of televised courses.

(g) Institutions offering courses through televised instruction shall submit to the Coordinating Board annual financial reports on direct operating expenditures for televised instruction. These reports shall be used to evaluate current funding procedures and levels.

(h) Courses offered through televised instruction must include print materials and live interactive sessions with the instructor of record. At a minimum, this interaction must include:

(1) An orientation session or sessions at the beginning of the course;
(2) Periodic scheduled sessions between the student and the instructor of record, either on an individual basis or in a group setting; and
(3) Provision for access by the student for advice or consultation with the instructor of record, by telephone or other means.

(i) Students who wish to enroll in courses offered through televised instruction must satisfy the same requirements for admission to the institution, to the program of which the course is a part, and to the course itself, as would be expected of students enrolling in the same course taught in the traditional on-campus manner.

(j) Faculty members teaching courses offered through televised instruction must be regularly employed faculty members or must meet the standards and procedures used by the institution for the appointment of faculty responsible for on-campus resident credit courses. Provision must be made for the review and approval of faculty at the departmental level in the fields affected.

(k) Procedures for evaluation of faculty responsible for courses offered through televised instruction must be equivalent to those used by the institution for the evaluation of faculty teaching on-campus resident credit courses.

(l) Procedures for evaluation of the organization, content, and delivery of courses offered through televised instruction must be equivalent to those used by the institution for evaluation of course organization, content, and delivery in on-campus resident credit courses.

(m) Each course offered through televised instruction must include procedures for monitoring and assessing student performance. These procedures—such as written exercises, papers, and examinations—must be the same as or equivalent to those used in comparable on-campus resident credit courses. Standards for success or failure in televised instruction must be as rigorous as those for on-campus resident credit courses.

(n) Each instructor of record in a course offered through televised instruction must provide timely feedback to students regarding their progress

and performance, by methods equivalent to those used in on-campus resident credit courses.

(o) Whenever televised instruction permits the enrollment of substantially greater numbers of students in a course than would normally be taught in a similar class on campus, the institution must ensure that quality is maintained.

(p) Students enrolled in televised instruction must have access to all academic support services which the institution provides for students enrolled in on-campus resident credit courses, including academic advising, counseling, library and other learning resources, tutoring services, financial aid, etc. In addition, students enrolled in televised instruction must have access to campus events and other nonacademic activities on the same terms as students enrolled in on-campus resident credit courses.

(q) Telecourse materials produced outside or within the institution must be evaluated and selected by an institutional team including individuals with competence in the content material, instructional methods, and televised instruction methodology.

5.195. **Institutional Plan.**

(a) Any institution seeking authority to offer televised instruction must submit an Institutional Plan for Televised Instruction for review by the Advisory Committee on Telecommunications and approval by the Coordinating Board. An institution previously authorized to offer televised instruction on an experimental basis prior to the adoption of this subchapter shall be required to submit an Institutional Plan for approval as set out herein. The plan must reflect institutional policies for offering televised courses and maintaining quality in accordance with these rules and regulations. In addition, the plan must include a description of institutional arrangements for operation of the televised instruction program.

(b) The Institutional Plan must include identification of the courses to be offered by televised instruction. Any additional courses selected for offering by televised instruction after the Institutional Plan has been approved are subject to the Coordinating Board's established course update procedures.

(c) The institution shall stipulate the maximum proportion of the course requirements any student may take by televised instruction for a degree or certificate program and provide a rationale where the proportion stipulated exceeds one-third.

(d) The Coordinating Board shall provide guidelines to assist institutions in preparation of institutional plans for televised instruction.

(e) Upon review of the plan, the Coordinating Board staff may request additional information.

(f) The Coordinating Board shall serve as a clearinghouse for televised instruction to facilitate the exchange of information on materials used in courses offered via television.

5.196. **Institutional Self-Study.**

(a) Each institution offering televised courses shall conduct a self-study of its televised instruction within four years of Coordinating Board approval of a plan and every five years thereafter.

(b) The self-study report shall be available to the Coordinating Board and its staff if requested.

(c) The Coordinating Board shall provide guidelines to assist institutions in preparation of their self-study reports.

5.197. **Statewide Review.**

A statewide review of televised instruction shall be conducted under the auspices of the Coordinating Board in 1989 and periodically thereafter as determined by the Board. The review team shall consist of consultants with expertise in televised instruction. The team shall evaluate and make recommendations to the Commissioner concerning the institutional self-study reports, the Coordinating Board's rules and regulations, and any other topics of interest to the Board.

APPENDIX B
Project ALLTEL and Its Recommendations

Project ALLTEL—Assessing Long Distance Learning Via Telecommunications—was a joint effort of the Council on Postsecondary Accreditation (COPA) and the State Higher Education Executive Officers (SHEEO). Following two years of study, the two organizations jointly issued a series of recommendations targeted at both the states and the accrediting community in order to ensure quality in the delivery of distance learning. Among the general principles and recommendations were:

1. Policies for assessing long distance learning should not discourage the development and use of technology.
2. All states should have adequate authorizing legislation in order to provide protection to consumers.
3. State authorization should be the first step and a necessary prerequisite to accreditation of long distance learning.
4. Institutions should develop and use rigorous outcome measures to assess program effectiveness.
5. The necessity of an institution's seeking state authorization depends in large measure upon the institution's physical presence in the state.
6. Institutions should give to the appropriate state agencies and accrediting bodies advance notice of intent to initiate programs.
7. State agencies should seek more uniform authorization requirements. Toward that end the ALLTEL project developed a model "Institutional Profile" to be used by both state agencies and accrediting bodies.
8. Accrediting bodies should continue to develop standards and procedures for off-campus programs including instruction delivered via telecommunications.
9. Accrediting bodies should create better mechanisms for the exchange of information about programs operating nationwide.
10. Accrediting bodies should require institutions involved in long distance learning to have the appropriate state authorization to operate.

A full description of the ALLTEL project and its products (including the institutional profile) is available in a summary report from COPA, One Dupont Circle N. W., Washington, DC 20036.